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Report of the Committee of the Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, appointed to ascertain, by experiment, the Value of Water as a Moving Power.

[CONTINUED FROM PAGE 299.]

8. *On the number and form of the buckets of an overshot wheel.* —The question of the relative value of elbow and centre buckets has been already examined (p. 221) by experiments made upon the high overshot wheel No. I. The convenient size of wheel No. IV induced the committee to use it in the more extended examination of questions in reference to the number and form of buckets. The number of elbow buckets applied to it was changed from twenty to forty, and oblique buckets, as well as curved buckets, of two different forms, were experimented with. The forms and other particulars relating to these buckets are given in a former part of this report (Jour. Frank. Inst., vol. x, p. 297, Plate VIII.)

A comparison of the ratios of effect to power, and of the velocities with wheel No. IV, with twenty and with forty elbow buckets, is given in the annexed table taken from tables 1 and 2 (vol x., pp. 298 302, Jour. Frank. Inst.)

TABLE TWENTY-FOURTH.

Comparison of overshot wheel No. IV, with twenty and with forty elbow buckets.

Head above gate.	Width of aperture.	Table 1, forty buckets.		Table 2, twenty buckets.		Table 1, forty buckets.		Table 2, twenty buckets.	
		Ratio of effect to power.	Mean ratio.	Ratio of effect to power.	Mean ratio.	Velocity of wheel.	Mean velocity.	Velocity of wheel.	Mean velocity.
Feet.	Inches.					Feet.	Feet.	Feet.	Feet.
0.25	0.50	.911		.867		5.94		5.86	
"	0.75			.824				5.78	
"	1.00	.852		.750		5.29		5.71	
"	1.25	.833				5.22			
"	1.50	.798		.739		6.29		5.71	
"	1.75	.731	.825		.795	5.49	5.65		5.76
0.75	0.38	.795		.842		5.03		5.94	
"	0.50			.800				5.86	
"	0.75	.801				5.57			
"	1.00	.755				5.35			
"	1.25	.748	.775		.821	5.49	5.36		5.90
		Mean	.800		.808		5.50		5.83

The average of the ratios of effect to power is nearly identical in the two cases, and the velocities are in the ratio of one to 1.06.

In the individual experiments the advantage is sometimes in favour of one set and sometimes of the other. It seems then that there was no advantage gained by increasing the number of elbow buckets upon this wheel, the original number being twenty, and the space occupied upon the soling, in the clear, by each bucket being about eight and a half inches, or from centre to centre an arc of eighteen degrees.

In the annexed table the ratios of effect to power and the velocities of wheel No. IV are compared when it was furnished with forty elbow buckets and with thirty inclined buckets. The deductions for the forty elbow buckets are taken for comparison, because the results are more numerous than those with the twenty buckets. Experiments are taken, in which all the circumstances were the same, and which corresponded to maximum ratios of effect to power.

TABLE TWENTY-FIFTH.

Comparison of elbow buckets with inclined buckets. Overshot No. IV.

Head above gate.	Width of aperture.	Elbow buckts. table 1.		Inclined buckets table 3.		Elbow buckets, table 1.		Inclined buckets, table 3.	
		Ratio of effect to power.	Mean ratio.	Ratio of effect to power.	Mean ratio.	Velocity of wheel.	Mean velocity.	Velocity of wheel.	Mean velocity.
Feet.	Inches.					Feet.	Feet.	Feet.	Feet.
0.25	1.00	.852		.808		5.29		4.57	
"	1.25	.833		.781		5.22		4.34	
"	1.50	.798		.803		6.29		3.97	
"	1.75	.731	.803	.772	.791	5.49	5.57	3.81	4.17
0.75	0.75	.801		.770		5.57		3.25	
"	1.00	.755		.777		5.35		2.97	
"	1.25	.748	.768	.763	.770	5.49	5.47	3.61	3.28

As in the last comparison, the *ratio of effect to power with the two varieties of buckets appears to be the same*, but there is a *great falling off in the velocity of the wheel by the use of the inclined buckets.* Some of the experiments taken as corresponding to maxima do not appear, from an inspection of the table, to fulfil the condition of true maxima, but others are unexceptionable, and as all show the same falling off in the rate of motion of the wheel, it must be taken as proved.

The explanation of this fact is, probably, to be found in the more or less favorable direction in which the water strikes the wheel. An inspection of fig. 3, Plate VIII, (vol. x, p. 296, Jour. Frank. Inst.) and a comparison with fig. 1, of the same plate, will show that the direction of the oblique buckets was much less favorable to a transfer of the force of the impinging water in the direction of the motion of the wheel. As it appears that the velocity of the impinging water is the circumstance which determines the velocity of the wheel, it might be concluded that any difference in the force with which, or the mode in which, the water strikes the wheel will produce a change in the velocity of the latter. Hence a change in the form of the buckets of the wheel, or in the form of the gate, where the chute is not of considerable length, will affect this velocity. This is probably the physical explanation of some of the difficulties heretofore stated in the conclusions in reference to the velocity of the wheel. Before passing these in review, we propose to examine the relative value of elbow and curved buckets; the effect of the use of these latter in the wheel will strengthen the conclusions in reference to the oblique buckets.

A comparison of the same elbow buckets with the curved buckets

before referred to is accordingly given below. It will be recollected that the second variety of these buckets was formed by cutting away a portion of the extremities of the first. The table referring to these (vol. x, p. 370, Jour. Frank. Inst.) shows no proper maximum, but the experiment giving the greatest ratio of effect to power has been taken for comparison.

TABLE TWENTY-SIXTH.

Comparison of the elbow and curved buckets. Overshot No. IV.

	Ratios of effect to power.			Velocities of wheel.		
	Elbow buckets, table 2.	Curved buckets, table 4.	Curved buckets, table 5.	Elbow buckets, table 2.	Curved buckets, table 4,	Curved buckets, table 5.
Feet.				Feet.	Feet.	Feet.
0.25	.795	.766	.793	5.77	4.36	3.36
0.42						
0.75	.821			5.90		
1.75		.678			4.04	
2.75	.645			6.65		

The comparison of the two varieties of curved buckets was in a degree vitiated by the removal of the wheel from the breast, in the experiments recorded in table 5, but the conclusion is fully warranted by the experiments from table 4, that in regard to the *ratio of effect to power the curved buckets are nearly equal to the elbow buckets, while in reference to the velocity of the wheel they are much inferior to them,* when the water is delivered as in these experiments. The velocities of the wheel with the two kinds of elbow buckets, with the first form of curved buckets, and with the oblique buckets, were at a mean as 5.6 to 4.2, and 3.7.

The reason assigned for the reduction of the velocity by the use of the oblique or of the curved buckets would, if correct, render it probable that with the mode of delivering water to the wheel adopted in the experiments there would be a gain in the velocity of the wheel, used as an overshot wheel, by employing centre buckets. Accordingly it will be found, by referring to page 222, that the average increase in the velocity of the wheel, under various heads, was about five per cent.

Again, the application of the same principles satisfactorily explains why it was found in tables fourth and fifth (pages 147–8) that the velocity of the wheel differed when the different gates *a*, *b*, and *c*, were used to deliver the water; being on the average in the proportion of 1.115, to 1.305, and 1.245 for the three gates respectively. The examinations of the quantities of water discharged by the three gates, made in table eighth, (page 151,) and again in table thirteenth (page 219) showed that *b* and *c* acted, in fact, as adjutages in modifying

the flow of water from them, the increase in the quantity of discharge being attended with a decrease in the actual velocity of the water delivered to the wheel, from an increase in the real area of discharge by the aperture acting in part as an adjutage. The velocity calculated from the quantity discharged is thus greater than the actual velocity. Hence while the actual velocity of the wheel is increased by the more favorable direction in which *b* and *c* delivered the water to it, the velocity of the water calculated from the quantity discharged by the same gates is apparently increased also, and the ratio of the velocity of the wheel to the velocity of the water appears correctly, at a mean, as shown by table tenth (page 153,) to be constant.

A further confirmation of these views will be found in the experiments to be referred to subsequently, on the comparison of the mode of admitting water to the buckets of an overshot wheel through a chute and by drawing it from the surface of the forebay.

Many difficulties in relation to the variations in the velocity of the wheel, are thus satisfactorily cleared up by reference to a physical cause, which is adequate to explain them, and the mode of operation of which may be readily estimated, though all the attending circumstances are not sufficiently well known to admit of calculation. We are inclined to refer to this same cause the unexplained, but sufficiently well established, effect of variations in the quantity of water supplied to the wheel, that is in the aperture of discharge, (pp. 217–8) upon its velocity. Thus, in theory, the two practical conclusions from the experiments, the first referring to the effect of an increase of quantity and the second to the effect of a change in the form of the gate would be referred to one cause, the same, also, in fact which produces a change in the velocity of the wheel by a change in the form of buckets.

The conclusion is fully warranted, from these comparisons, that in any circumstances not included within the range of these experiments, in which the velocity of the water, or the mode of its transmission to the wheel, should be changed, a corresponding change would take place in the velocity of the wheel.

9. *Comparison of the mode of admitting water to an overshot wheel through a chute, or by drawing it directly from the surface.* The mode of making this comparison is fully detailed in the introduction to the tables relating to wheel No. IV, (Jour. Frank. Inst. vol. x, p. 296.) The sudden falling away of the ratios when the latter mode of admitting water was adopted, leaving no room to doubt in reference to the result, notwithstanding that no maximum is shown in either case by the table, (No. 5, parts 1 and 2.)

TABLE TWENTY-SEVENTH.

Comparison of the mode of supplying water to an overshot wheel through a chute, and by drawing it from the surface. Wheel No. IV.

Table 5. Parts 1 and 2.	Head above gate.	Head and fall.	Velocity of wheel.	Ratio of effect to power.
	Feet.	Feet.	Feet per second.	
Chute, ...	0.42	6.67	3.26	.793
From surface, .	0.23*	6.67	3.06	.606

* In the table this is erroneously given as 2.75 feet. It should be 2.75 inches.

The proportion of the ratios in the two cases is as .793 to .606, or as 1.31 to 1.00, and the velocities bear the ratios of 1.1 to 1. The result in reference to the velocities confirms the general conclusions before referred to, (page 365.)

10. *Delivery of the water to the wheel through two gates acting in succession.*—It is easy to see that the admission of water through two gates acting in succession may be advantageous, when owing to the construction of the buckets or the large quantity of water admitted to the wheel, the water does not enter the buckets readily, but meets with considerable impediment in its passage to the lowest part of the buckets. When the buckets are constructed with due reference to the quantity of water to be received by them, it does not appear probable that two gates acting successively can have any particular advantage over one. Experiments upon this subject were made with wheel No. III, the arrangements in reference to which are described in a former part of this report, (Jour. Frank. Inst., vol. x, p. 11, Plate VII.) The experiments which are most directly comparable are collected in the following table.

TABLE TWENTY-EIGHTH.

Comparison of the effects of a single gate delivering water to an overshot wheel, with two gates acting in succession. From table I, parts 2 and 3, and from table II, parts 1 and 2. Overshot No. III.

Head above bottom of gate.	Head and fall.	Aperture.		Ratio of effect to power.	
		a.	b.		
Feet.	Feet.	Inches.	Inches.	One aperture.	Two apertures.
2.75	13.00		1.00	.689	
"	"	0.50	0.50		.724
3.75	14.00		0.62½	.631	
"	"	0.37½	0.25		.658
0.25	10.50	1.50		.669	
"	"		1.50	.670	
"	"	0.75	0.75		.692
0.75	11.00		1.50	.780	
"	"	0.75	0.75		.758
1.75	12.00		1.00	.726	
"	"	0.50	0.50		.754
2.75	13.00		1.00	.668	
"	"	0.50	0.50		.702
3.75	14.00	0.75		.654	
"	"		0.75	.604	
"	"	0.37½	0.37½		.678
			Mean	.677	.709

The reasons why the ratios of effect to power contained in this table fall short of those formerly commented upon are that the heads above the gate in the former part of the table have a considerable proportion to the head and fall, and that in the experiments contained in the latter part no breast was used. A reference to the individual experiments shows some uncertainty as to whether the ratios actually represent maximum effects or not, but in the advanced stage of the experiments at which these results were obtained, an experiment which did not promise well was frequently not continued to its close, and hence these conclusions are probably near the truth.

The average ratios with the single aperture and with the two acting successively appear to be .677 and .709, being in favour of the latter; the proportion is as one to 1.047 nearly. The average velocities in the two cases are more nearly equal, being 6.19 and 6.42, or in the proportion of 1 to 1.037.

11. *On the use of a breast with an overshot wheel.*—Experiments for comparing the results with an overshot wheel and elbow buckets used with a close breast and without a breast, were made with wheel No. III, and are contained in tables I and II referring to that wheel, (Jour. Frank. Inst., vol. x, pp. 12–16.) In the following table the conclusions are brought together. The part above the first line which gives a mean of the results, contains experiments made under precisely similar circumstances, except in reference to the breast, and the first and second columns of the table point out the experiments in tables I and II from which the numbers for the velocities of the wheel, and for the ratios of effect to power, have been obtained. In the part of the table below the first line of mean results, the averages of all the highest results under each head, with and without a breast, are given, bringing a greater number of experiments to bear upon the conclusion, but comparing these not alike in the circumstances of the aperture by which the water was admitted to the wheel.

TABLE TWENTY-NINTH.

Comparison of the results with overshot wheel No. III, with and without a breast.

Table I.	Table II.	Head above gate.	Head and fall.	Velocity of wheel.		Ratio of effect to power.	
				With breast.	Without breast.	With breast.	Without breast.
No. of the experiment.		Feet.	Feet.	Feet.	Feet.	Power = 1.	
3	1 & 4	0.25	10.5	4.52	4.40	.817	.670
8	10	0.75	11.0	5.20	5.51	.809	.780
13	15	1.75	12.0	5.94	5.78	.758	.726
16 & 34	18 & 19	2.75	13.0	6.65	6.86	.706	.685
40 & 49	21 & 31	3.75	14.0	7.39	6.80	.664	.627
		Mean		5.94	5.87	.751	.698
No. of maximum.							
1	3	0.25	10.5	4.52	4.20	.817	.677
1	2	0.75	11.0	5.20	5.72	.809	.769
1	2	1.75	12.0	5.94	5.61	.758	.740
5	2	2.75	13.0	7.08	6.86	.711	.685
5	6	3.75	14.0	7.22	7.29	.666	.657
		Mean		5.99	5.94	.752	.706

The mean of the several results obtained by the two methods just explained does not differ materially, particularly the mean of the ratios of effect to power, which appears to be in favour of the use of the breast in the proportion of .751 to .702, or of 1.06 to 1.00, under

the average of heads from 0.25 to 3.75 feet, and of head and fall from 10.5 to 14.0 feet. The velocity of the wheel being determined by that of the water impinging upon it does not differ in the two cases in question.

[TO BE CONTINUED.]

Civil Engineering.

Extracts from the Treatise on Geodesy, by L. B. FRANCŒUR. *Translated by* W. H. EMORY, *Lieut. U. S. Topographical Engineers.*

[CONTINUED FROM PAGE 319.]

[Translated for the Journal of the Franklin Institute.]

15. *The Land Surveyor's Square.* This instrument resembles the head of a cane, (fig. 17,) in which is cut two rectangular vertical openings A C D G, O F E I, which serve as sights. The lower part of these openings is cut in the form of a window, and to direct them towards a signal, the eye is applied to the opposite slit. In the bottom of this head is a socket which receives the head of a staff and retains it there by friction. The extremity of the staff is shod with iron. To use this instrument, plant the staff vertically in the ground, and turn the square on its socket until one of the slits is on a line with some distant signal. Then without moving the instrument, place the eye at the other slit and have a signal put up on its prolongation. Thus a second line will be obtained perpendicular to the first. When the ground is rocky, a tripod is used instead of the single or jacob staff.

The land surveyor's square is used to trace on the ground, lines at right angles to each other; it can also be used to determine the area of pieces of ground. This is done in the following manner.

Suppose figure 20, Plate II, to represent the outline of the ground to be surveyed; go to different points in succession along the line A B, and find the places D, F, H, where if the instrument is placed, one of the sights will be directed along the line A B, while the other is directed on the respective angles or corners C, E, G, which limit the outline of the field. If this outline is a curve, it must be so divided into parts, that each may be regarded as a straight line. Place a signal at each station, D, F, H, and also at the angles C, E, G, and measure the lengths, A D, D F, F H, H B, and also that of the perpendiculars, C D, E F, G H. We have then all that is necessary to plot the outline and calculate the area.

For example:—Trace on the paper any indefinite right line *a b;* lay off on it with the dividers the distances *a d, d f,* &c. taken from the scale, which represent the distances measured on A B; then at

each division erect the perpendiculars, *d c, f e, h g*, also taken from the scale; the number of parts, in each case, taken on the scale, being the number of units, the lines measured on the ground. To get the figure *c a e b g*, nothing remains but to join the extremities of the perpendiculars by right lines. It is evident this plan is reduced to a horizontal plane, since all the distances measured were horizontal. If the object is to know the length of the sides and the angles of the polygon, they can be ascertained by the aid of the scale and the protractor.

This operation is intelligible to the most ordinary capacity; and hence the surveyor's square is in continual use; besides, it gives immediate results, as it is only necessary to calculate the trapeziums and triangles, into which the ground is divided.

When the field is not bounded by a right line, we take as a base a right line which traverses the field, and stake it out with signals. (Fig. 21.) The distances intercepted on the boundary, by perpendiculars from these signals, being assumed as right lines, the boundary is determined.

In this manner, the sinuosities of roads, streams, enclosures, &c., can be determined. But the inequalities of the ground, the difficulty of measuring horizontal distances, and the obstacles which intercept the view, added to the slowness of the operation, frequently make it necessary to use some other instrument.

The head of the land surveyor's square is generally made in an octagonal form, and with slits so cut as to make with each other angles of 45°. These are used on the same principle as those of 90°. To test the correctness of these angles, look through the sights, and place a signal in the direction of each, then turn the square on its socket until the adjacent sights are on a line with the signal, which the first sights covered; if the instrument is correct, the sights first looked through will then be in exact co-incidence with the next signal, &c.

16. *The Pantometer of M. Fouquier.* This instrument is an improvement on the square, (fig. 23, Plate II,) and is formed of a cylinder cut in two parts; the lower one, A B C D, is secured to a staff by the socket K, and the clamp screw P; the upper part E F G H, turns on an axis concentric with the first, so that the divisions traced on the edge E F, pass along those on the lower border C D. The fixed circumference is divided into degrees, and the arc passed over by the upper cylinder is given at *n*. The vernier *m* gives the fractional part of the degree. A slit is cut in the fixed cylinder at *a*, and another diametrically opposite at *b*, through the middle of which a horsehair is stretched vertically. The upper cylinder also has two

slits at *d* and *c*, the last of which is also furnished with a horsehair. Care must be taken that these sights, in both cylinders, correspond exactly with the zero points on the graduation of the lower limb and the zero point on the vernier. This is ascertained by placing the two zeros in coincidence, and looking at a signal.

The manner of using this instrument is very easy to understand. The two movements which the instrument has, namely, that of both the cylinders about the socket, and that of the upper cylinder about its axis, enable the observer to fix the lower sights on one signal, while those of the upper are directed towards another signal. The angle made by two visual rays, drawn through these sights from the point where the instrument stands, to the signal, is given on the circle C D, and the vernier *m*. This then is one means of measuring angles, and the use of the instrument in plotting will be seen in the article on the graphometer.

A compass is usually fixed on the top G H, by the aid of which, objects are laid down where obstacles interpose to obstruct the view. A spirit level is also attached, to enable the operator to place the axis of the instrument vertical.*

17. *The Graphometer.* This instrument is used to measure angles. It is formed like a graduated semicircular protractor, from 4 to 10 inches or more in diameter, furnished with alidades and mounted on a universal joint, such as has been described already, (No. 12.)

Perpendicular to the limb and near its periphery are placed two sights P, P, opposite each other. The plane which passes through these sights is perpendicular to the limb, and lies on the diameter marked zero and 180°. Another alidade L L, moves round the centre C, and, in all its positions, along the limb, in the direction of its radii. These sights are nearer to the centre than the others, and when the alidade is directed along the principal diameter, the hairs of the four sights should coincide, upon the eye being applied at the extremity. This alidade carries a vernier which enables the observer to read the fractional parts of a minute.

It is necessary that the centre of the graduated arc should be the axis of rotation, in order that the line of the fixed sights correspond with the diameter of zero and 180°, and that the line of sight of the movable sights also pass through the centre. These conditions being fulfilled, an angle is measured in the following manner. Turn the instrument in its socket, until the radius marked zero is directed on a signal; clamp the instrument and turn the alidade until the line of sight is directed on another signal. As it is difficult with the hand

* It is hardly necessary to observe that all the operations of the Land Surveyor's Square and Pantometer may be performed by any instrument capable of measuring angles.

to place the line of sight of the alidade exactly on an object, the tangent screw is used to complete the operation.

The universal joint is so constructed, that the plane of the limb can be made to assume a vertical position, the correctness of which is tested by a plumb line. The limb can also be made horizontal, for which purpose, two spirit levels n, n', are placed upon it, at right angles to each other. In this last case, the angle measured is that formed by the visual rays to the two objects, reduced to the horizon (fig. 22); in the other, the angle measured is vertical, and is the angular height of one point above another: and if the principal diameter is horizontal, which is ascertained by the spirit level, the angle is the angular height of the point above the horizon.

The graphometer is also furnished with a small compass, the north and south line or diameter of which is graduated 0° and 180°, and is parallel with the diameter of the limb. It serves to lay down on a map the magnetic meridian, and to direct the sights towards invisible objects, as will be described in the article on the compass.

The spirit levels and the compass are fixed on in such a manner as not to interfere with the movements of the alidade or the universal joint.

After moving the revolving alidade, care must be taken to look again through the fixed sights, to be assured that the instrument has not been moved; as it frequently happens, that the force applied to move the alidade, moves also the whole instrument, making it necessary to readjust the hair of the fixed sights upon the signal.

For the purpose of seeing objects at a distance, telescopes furnished with an object and eye-glass, are used in place of the sights. At the common focus of the two glasses, are two hairs at right angles to each other, one parallel and the other perpendicular, to the limb.

The fixed telescope is placed under the limb; the movable one above it. Their axes should correspond respectively with the zero points of the limb and the vernier. For the purpose of seeing objects not in the plane of the limb, each telescope is mounted on a shaft perpendicular to the limb, and has a limited vertical motion. To ascertain if the axes of the sights or of the telescopes are properly adjusted, direct both to the same distant object, and see if the zero of the vernier coincides with the zero of the limb. When it does not, there is an error of collimation, the value of which is the difference between the two zeros, and is a constant quantity which it is necessary to add to or subtract from the observed angle as the case may be. It is better, however, to destroy the error by moving the hairs. For this purpose, the hairs have a transversal motion given to them by the aid of lateral screws. A screw is also used to

give a motion along the axis of the telescope, to place them in the focus of the object-glass. The telescopes just described reverse objects; but no inconvenience results on this account.

For the purpose of discovering if the instrument is well centered and well divided, measure the angle formed by lines drawn from a station to two signals, by referring them to a third signal; the angle sought is either the sum, or the difference of the two angles measured. This done, change the position of the third signal, and the same operation should give the same result. Another mode is by measuring the three angles of a triangle, the sum of which should make 180°.

The Graphometer is used in many topographical operations, but it will be sufficient to describe the manner of projecting plans with it. Let A B C D E (fig. 24) be different objects situated in a country of which we wish to get the plan. Measure the length of a horizontal base A E, the position of which is so chosen that all or most of the objects can be seen from the extremities A and E, and that the angles subtended shall be neither too obtuse nor too acute, &c.

Then station the instrument at A, and measure all the angles included between the base line A E, and lines drawn to the other points; these angles are reduced to the horizon when the plane of the limb at the time of the observation is fixed horizontally; by this means we know the angles B A E, C A E, D A E, H A E, &c. This being done, remove the instrument to E, and measure the angles D E A, C E A, B E A, F E A, &c.* To avoid confusion, the values of all these angles should be recorded on a sketch, representing the objects in the order they were seen.

To plot the above, draw on paper a right line *a e*, equal in length to as many parts of the assumed scale, as there are parts in yards or feet, &c., found in the base line by measurement. From the point *a*, with the aid of the protractor or other instrument, (see No. 4,) draw the right lines *a b*, *a c*, *a e*, *a f*, &c., making angles with the base respectively equal to the angles observed at A; then from the point *e*, draw lines *e d*, *e c*, *e b*, *e f*, making with *a e*, angles equal to those observed at E. These lines will cut those first drawn at the points *b*, *c*, *d*, *f*, &c., shewing the positions of the several observed signals B, C, D, &c.

It may be proper to remark that with the aid of dividers and scale, the lengths A B, B C, C D, D E, &c., can be ascertained on the plot, although they were not actually measured. Moreover, if any object is invisible from one or both of the stations, the place it occupies on

* As a confirmation or correction, take some intermediate known point on the base and go through the same operation. Each required point will then be determined by the intersection of three lines.

the plot can be ascertained, by taking as a base the distance between any two other stations from which it can be seen; for example, the point I, visible from G and from F, is found by measuring the angles, I G F, I F G.

The Graphometer serves, as before shewn, to find the distance between objects which are inaccessible. It will soon appear, that it can be used to find the height of signals above the horizon. But as these propositions involve the resolution of problems in right line trigonometry, they will be treated of hereafter, (No. 45.)

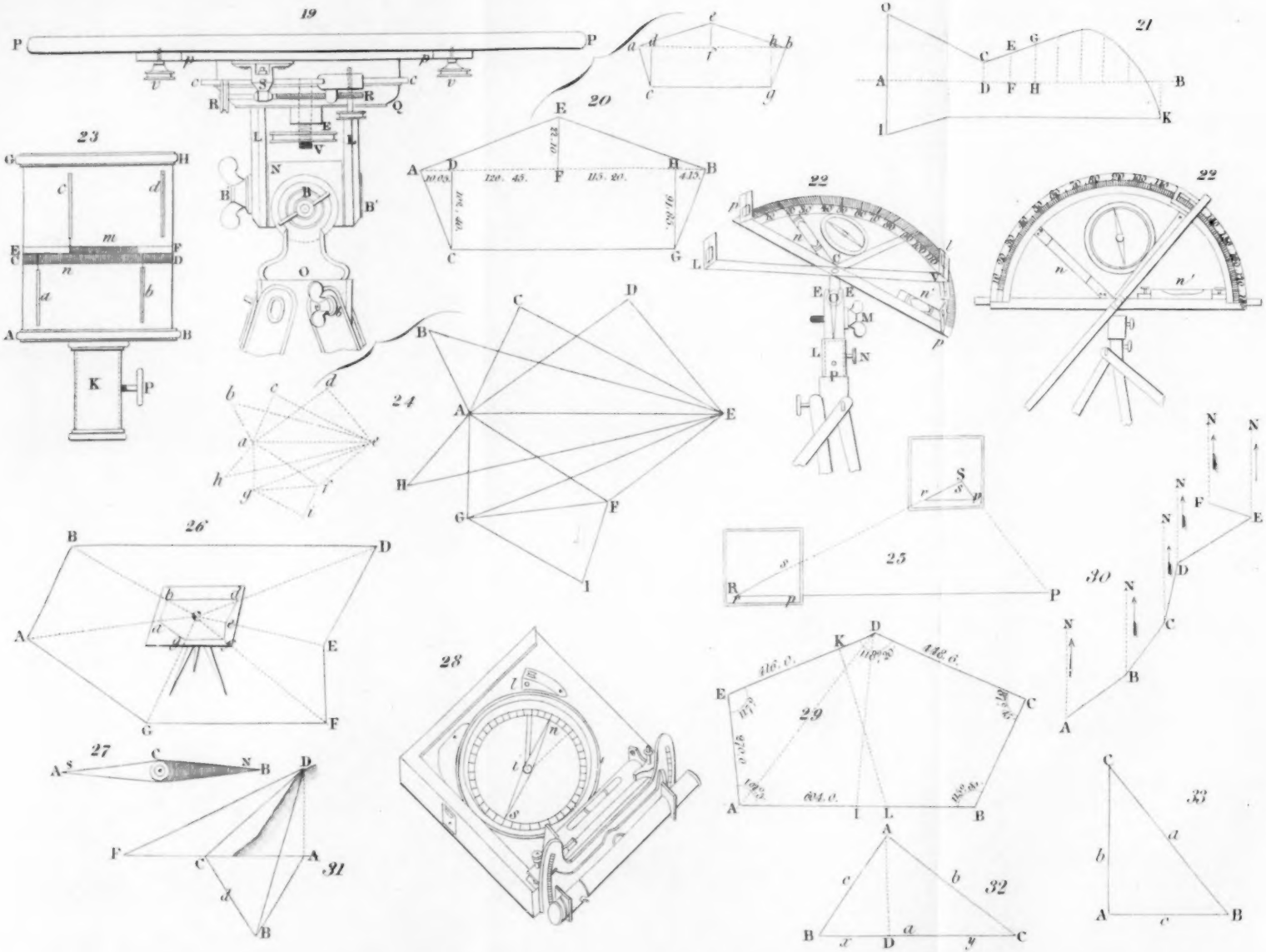
The method of intersections just described, saves much time and labour; but it is attended with the objection that it may be necessary to use angles that are very acute or very obtuse, which gives erroneous results. In this case it is best to make as many stations as there are signals, on the boundary of the locality to be surveyed, and measure the distance between the consecutive signals and the angles at each. Fig. 29 gives an example of this method, a more minute description of which is unnecessary here, as it will be found in the article on the plane table.

The repeating circle and the theodolite, which will soon be described, are also used like the graphometer to measure angles; but the complication of these instruments, the time it takes to adjust them and to make the observations, &c., prevent them from being used except in cases which require an extreme degree of precision, such as is seldom required in the details of topography. The sextant and the reflecting circle described in the treatise on navigation can be very conveniently used in measuring angles, more so than even the graphometer; but they give the true and not the projected angle.

[TO BE CONTINUED.]

Arching of Tunnels through Friable Rocks. By Ellwood Morris, *Civil Engineer.*

Where tunnels are cut through a material firm enough to sustain itself during the process of excavation, but not sufficiently solid to answer subsequently, without the protection afforded by an arch; economy and convenience usually require that the whole or nearly all of the excavation should be completed before the arching is taken in hand: for the darkness and contracted space in tunnels, render it quite difficult to work, advantageously, gangs of men employed at the same time, in two such different operations; the miners blasting and moving out material, and the bricklayers bringing in their bricks and mortar, all by the same railroad (unless two tracks are laid) produce interferences, the one with the other, which are found in practice to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be prejudicial to a just economy in execution, and often may require a longer time for the accomplishment of both, than if the labour was divided and each advanced independently.

Hence in tunnels through friable rocks it is usual, firstly, to perforate the hill and trim out the transverse section; secondly, to turn and pack the arch; thus dividing the construction into two distinct operations.

So much time is commonly consumed in the tedious process of tunneling that such works are almost invariably driven both day and night; and the excavation being accomplished, it will generally be necessary (in order not to detain the opening of the work for use) to press the arching forward with the utmost expedition: to do which requires some ingenuity in arranging the work and stationing the workmen, so as to be enabled to employ in the tunnel a powerful force; and this will be found impracticable in such confined situations, without peculiar arrangements different from what would be adopted in works in the open air.

The longest tunnel in America—that of the Chesapeake and Ohio Canal at the Pawpaw bend of the Potomac river—being 3,118 feet in length between its portals; is cut through a slate rock of such character that a thorough arch is indispensable to the safe and uninterrupted transit of boats: but the roof of rock being sufficiently firm to sustain the mass of the hill above, whilst it is not enough so to prevent continual and heavy scaling from the soffit, a light arch, *well packed*, has been designed to keep the material in place and make the roof safe; the side walls or abutments to be thirteen inches, or a brick and a half, and the arch nine inches, or one brick, in thickness; its span being twenty-four feet, and its intrados a semicircle.

This tunnel having been carried on with the intention of nearly completing the excavation before commencing the arch, and that part of the work being nearly done, it became the duty of the writer to devise the means of inserting this arch, with the least possible delay; and as it pertains to a subject of professional importance, an extract will be given from a late report to the Directory of the Chesapeake and Ohio Canal Company, with the hope that it may induce some of the writer's professional brethren to communicate their observations upon kindred subjects, through the pages of this Journal, which it affords the Committee on Publications great pleasure to open for the purpose of bringing forward their experience and views upon this or other matters of engineering.

***Extract from a Report made to the President and Directors of the Chesapeake and Ohio Canal Company, by* Ellwood Morris, *Chief Engineer, December 31st*, 1840.**

As it has been imagined by some that the arching of the tunnel would require a very long time, it may be as well to give an outline of the plan upon which I have long contemplated proceeding with this portion of the work; and by the execution of which I have entire confidence that, with a heavy force, this formidable arch, though 3,118 feet long, and requiring about 3,500,000 bricks, can be constructed in a single year: the bricks being prepared beforehand and delivered at the portals.

By the experiment of Col. Pasley, of the Royal Engineers, of Mr. Brunel and others, the cohesive power of cement has been demonstrated to be so great, that from twenty to thirty bricks, with their longest dimensions vertical, had been stuck out horizontally from a wall, by adding successively a brick at a time, as soon as the cement joint of the preceding one had set.

Acting upon the principle of cohesiveness here developed; possessed, as it is in an eminent degree, by the hydraulic cement of the Potomac, which I contemplate using in the arch, at least without any admixture of sand, in order to procure a quicker set and firmer bond, I propose:

1. With a strong force to raise both side walls up to the springing line of the arch.

2. In sections of, say 500 feet, by reverse moulds and without centering, to carry up the arch on both sides to the angle of repose; and bringing into play the coherence of the cement, even above it, say to an angle of forty or even forty-five degrees, as may be determined at the time.

3. By a system of detached centres, framed to leave open about thirty degrees of the crown, each supporting three feet lineal of the arch, and leaving an interval of four or more feet to be sustained by the cohesive power of the cement, to carry up the spandrels of the arch to an angle of seventy-five degrees or within fifteen degrees of the crown on each side.

4. By a very light centre, (capable of being handled by two men,) to key up the crown in sections of two feet, shifting the crown centre continually, (upon a platform carried by the detached system,) as each successive section of the crown is keyed up and packed.

Those who are conversant with practical affairs, will at once perceive that, by working in long sections, course by course successively, the cement will set in one part whilst the workmen are engaged at

another; and that by the division of labour indicated in the above outline, a very large force can be employed upon the arch, and so organized as to finish each part in detail; the most tedious portion, that of keying up, being limited by the mode of operation, to thirty degrees of the crown alone, or but one-sixth of the semi-circle, can be advanced by working only from a single point, at the rate of ten feet lineal per day.

Oldtown, Md., April 18th, 1841.

Extracts from the Report of M. R. Stealey, *Resident Engineer of the Kentucky River Navigation, to* Sylvester Welch, Esq., *Chief Engineer of Kentucky. Dated Frankfort, December* 1, 1840.

"Notwithstanding the extraordinary efforts which were made in the fall of 1839, and continued through the winter, it was found impracticable to complete locks, and dams Nos. 2, 3 and 4, before the winter freshets occurred. The lock walls were not carried up to their full height—the machinery for working the gates was only temporarily and partially attached—the covering of the dams was incomplete—the approaches to the locks not fully formed—and the banks were in a degree unprotected from abrasion by the floods. It will be recollected that throughout the whole of last summer and fall, and indeed up to the middle of January, the Kentucky river remained at an unusually low stage. The timber which had been cut off the banks along the pools of dams Nos. 2, 3 and 4, during the summer, consequently lay where it had been felled until the dams were nearly completed. Upon the first rise in the river, the whole floated off and lodged in immense compact masses immediately above the several dams. At Cedar, dam No. 3, the gorge extended about a mile in length, and was probably from ten to twenty feet in depth. In the early part of February, the river rose to a considerable height, and the floating masses passed over the dams with great violence." * * *

"The repairs have been completed in a manner which, it is believed, will render them permanent. Dams Nos. 2 and 3 are filled with stone in all parts; No. 4 is not filled above the angle of the breast under the lower slope. In place of the spike bolts used heretofore, long key bolts, of inch and quarter square iron, have been used to secure all the upper range timbers to which the covering plank is attached; those bolts pass down through the lower timbers of the dam, are secured by keys underneath, and are not liable to

become loosened and drawn out by the tremor of the dam or the action of the water."

"The advantages of flat lower slopes to dams were clearly exemplified in the action of the water at the several sites. At No. 3 the greater portion of the lower slope of the dam, in its incomplete condition, was wrenched off, so as to leave a vertical face in the line of the comb; whilst at Nos. 2 and 4, the general outline of the slope remained undisturbed. At the former the water fell over vertically upon the rock foundation; at the latter, the water, guided and upheld by the slope, expended much of its force in a horizontal direction against the back water below. At No. 3 the rock was torn up to such an extent as to form a bar across the river, immediately below the dam, which has yielded rock sufficient to fill up the whole of the dam below the comb; at No. 2, on the contrary, which is built upon a gravel foundation, sand, gravel, brush, &c. were deposited to a depth of several feet against the lower side of the dam, and the foundation remained secure, although the gravel bed of the river was cut away at some distance below the dam: at No. 4 also the rock bed of the river remains unchanged. Again, at No. 3, the water, even at its highest stage, had a fall of about two feet, and at medium stages reacted from a line about one hundred feet below the dam, forming a rapid surface current, *up stream*, across the whole width of the river. The drift, in passing over, disappeared beneath the surface, rose below, and was then brought back against the dam with such violence that the shocks might be heard distinctly for the distance of a mile. In this manner large trees were seen to be worn, and rounded off at the ends, by repeated impingements against the dam, until finally the accumulation of their numbers forced them away to make room for others. At no stage of water could a craft of any kind have passed in safety over the dam. At Nos. 2 and 4, on the contrary, where the general outline of the slope remained unbroken, there was no reaction at the surface at any stage of water, and the ordinary drift passed directly off without detriment to the dams. At the highest stage of water (15 feet on the dam) there was but a very few inches difference in the level of the surfaces above and below the dam, and the water glided off with a gentle undulatory motion. Steamboats have passed, in both directions, over dam No. 2, and could have passed over No. 4, at the highest stage of water, had an opportunity offered. The slope of No. 3 is now replaced, and it is believed that the drift will in future pass over that, as at the other dams, without doing further injury.

The steamboat New Argo, Captain Armstrong, was the first to pass through the locks, and arrived at Frankfort on the 14th of

February. The navigation continued open, for steam and flat boats, so long as the river continued navigable below lock No. 2, with some intermissions resulting from the incomplete condition of the lock-walls."

* * * * "The whole cost of the improvements is estimated at $848,960, including superintendence, lime, purchase of land at the various sites, and all contingencies. The amount of work done is $746,046.32. Amounts paid as follows, viz: to contractors, $563,711.01; manufacture of hydraulic lime, $53,978.76; transportation of hydraulic lime, $22,641.58; clearing the timber from the banks of the river, $18,525.50; purchase of land, $2,776.48; superintendence, engineering and surveys, $24,837.02; making a total amount paid, $686,470.35. The amount due for work done, including retained per centage, $59,575.97; value of work yet to be done, $102,913.68; and the amount required to complete the improvement, in addition to the amount already paid, is $162,489.35." * * *

"It may not be uninteresting to the geologist, to state that in nearly all of our excavations, detached teeth and bones of the mammoth have been found, in a state of excellent preservation, at depths generally of fifty feet below the surface of the ground, and at distances of one hundred to one hundred and fifty feet from the margin of the river."

Extract from the Report of N. B. Buford, *Resident Engineer of the Licking River Navigation, in Kentucky. Addressed to* S. Welch, Esq., *Chief Engineer. November*, 1840.

"The lime which was used, during the last year, on the Licking river, was obtained from the establishment at Louisville. The quantity derived from that place was 3,695 barrels in the year 1839, and 1,400 barrels in the present year, which have been distributed among all the locks."

"It having been previously ascertained that near locks Nos. 1, 2, 4 and 5, a material existed which was capable of being manufactured into hydraulic lime, in the month of June, by your directions I commenced erecting a horse mill and kiln at lock No. 2, according to plans furnished by yourself. On the 18th of August, the kiln and mill were put into operation; and, as soon as a little experience had been acquired in burning the lime and attending the mill, they were found capable of answering the purpose for which they were intended."

"The mill, kiln, and a house for the hands employed about the establishment, have cost $1,600; and we are capable of manufactur-

ing 60 bushels of lime per day, at a cost of 25 cents per bushel. We have already made 3,600 bushels of lime, at a cost of $900, and apprehend that it will not cost more in future. The mill at No. 2, by being kept employed all the year, will be capable of making all the lime required for locks Nos. 1 and 2. The transportation of the lime to No. 1 will cost about 8 cents per bushel. If the amount required at the two locks should be 20,000 bushels, and the mill should be useless at the close of the work, its cost would be an increase of 8 cents per bushel on the lime made. So the lime at No. 2 would cost 33 cents per bushel; and that at No. 1, by adding the transportation, would cost 41 cents."

"The lime made has been fully tested, and found to be of a good quality. It does not set so readily as that from Louisville, but in two or three weeks it is equally hard."

Second Report of the Directors of the New York and Erie Railroad Company, to the Stockholders. February 3rd, 1841.

[CONCLUDED FROM PAGE 328.]

NOTE D.—TOLLS ON COMMON ROADS INCREASED BY RAILROADS.

"The report of the minister of public works in Belgium, states a remarkable fact, and one at variance with the anticipations of most persons. It was supposed that this new mode of transport, introduced to the extent now practised in Belgium, would destroy the old, and that the use of horses and ordinary carriages would be superseded. Such is not the fact. On the contrary, while railroads have been, in succession, extending themselves over the whole of the soil of Belgium, the produce of the tolls on the ordinary roads, instead of diminishing, has progressively increased. In proof of this, the following statement of the produce of the tolls is given:—

1831, - - -	2,390,882 *fr.*	1836, - - - - -	2,447,985 *fr.*
1832, - - -	2,195,343	1837, - - - - -	2,584,791
1833, - - -	2,360,464	1838, - - - - -	2,759,543
1834, - - -	2,415,769	1839, 10 months,	2,749,301
1835, - - -	2,385,430		

Mr. Nothomb makes a comparison of the advantages to the public, in time and money, between the old mode of traveling by diligences, and the rate of traveling under the new tariff, which went into operation in 1839.

The average result is a saving of *half the time*, and of 33 per cent. in the price.

The saving in price is thus subdivided: in diligences 15 per cent.; chars-a-bancs 30 per cent.; wagons 60 per cent. It is the lower class who profit most by the establishment of railroads. They not only find the means of transport, which were almost denied them before, but they find the means of labour increased. It is officially stated in

this report that the building of the railroads of Belgium has produced the result of increasing the produce of all the indirect taxes."

Increase of Passengers by the Establishment of Railways.

"From Baron Charles Dupin's Report on the Paris and Orleans railway. Experience has proved both in France and abroad, that in a short space of time the facility, expedition, and economy afforded by railways more than doubles the number of passengers and the quantity of merchandize.

In order to support such statements, we will quote the following facts relative to the railways of Belgium, England, and Scotland, in positions of extreme difference, and giving rise to a variation in the returns which far exceeded all anticipations."

"Comparison of the number of travelers conveyed daily throughout the whole, or a portion of the line:—

Railways.	*Before the establishment.*	*After the establishment.*
Manchester and Liverpool,	400	1,620
Stockton and Darlington,	130	630
Newcastle and Carlisle,	90	500
Arbroath and Forfar,	20	200
Brussels and Antwerp,	200	3,000

Increase of the number of passengers by the establishment of a Railway:

Liverpool and Manchester,	300 per cent.
Stockton and Darlington,	380 per cent.
Newcastle and Carlisle,	455 per cent.
Arbroath and Forfar,	900 per cent.
Brussels and Antwerp,	1,400 per cent.

Thus, even taking as a criterion the road on which the proportional increase is least of all, we still find that the number of passengers will increase not only 100 but 300 per cent. The transport of merchandize will experience a similarly rapid increase.

Progress in the conveyance of merchandize by Railway, compared to that of passengers:—

Year.	*Passengers.*	*Tons.*
1834,	924,063	22,909
1836,	1,248,552	161,501
1838,	1,535,189	274,808

Thus while the number of passengers has increased 60 per cent. in four years, in the same time the quantity of goods increased 1,100 per cent."

Extract from a late official report on English Railways, made to the French Government, by Edward Teisserence, its agent, charged with the special duty of making a study of these Railways:—

"The Darlington Railway has produced, by its low rate of passage and of freight, a complete revolution, in the region of country which

it traverses. It has increased the value of land 100 or 200 per cent. By these low rates, the freight, estimated at 80,000 tons, has been increased to 640,000 tons. The passengers, estimated at 4,000, have been increased to 200,000."

The following extract on the influence of Railways in developing the resources of a country, is taken from the second report of the Irish Railway Commissioners.

"On the Newcastle and Carlisle road, prior to the railway, the whole number of persons the public coaches were licensed to carry in a week was 343, or both ways 686; now the average daily number of passengers by Railway for the whole length, viz: 61 8-10 miles, is 228, or 1,596 in the week.

The number of passengers on the Dundee and Newtyle line, exceeds at this time 50,000 annually; the estimated number of persons who performed the same journey previous to the opening of the railway having been 4,000.

Previous to the opening of the railway between Liverpool and Manchester, there were about 400 passengers per day, or 146,000 per year, traveling between those places by coaches; whereas the present number by railway alone, exceeds 500,000.

In foreign countries the results arising from the same cause, are equally, if not more striking. The number of persons who usually passed by the road between Brussels and Antwerp, was 75,000 in the year; but since the railroad has been opened from the former place to Malines it has increased to 500,000; and since it was carried all through to Antwerp, the number has exceeded a million. The opening of a branch from Malines to Termonde, appears to have added 200,000 to the latter number; so that the passenger traffic of that railroad, superseding a road traffic of only 75,000 persons, now amounts to 1,200,000.

It is remarkable, that on this, as on most other railroads, the greatest number of passengers are those who travel short distances, being as two to one compared with those who go the whole distance. This appears from a statement read by Mr. Loch, before the Statistical Society of Manchester, showing that between April 30th and August 15th, 1836, 122,417 persons traveled the whole distance, and 244,834 short distances; chiefly to and from Malines."

(NOTE E.) *The following is a statement of the whole cost (including the amount raised by loans,) the lengths, cost per mile, etc., of a few of the principal railways of Great Britain. In every instance, the cost which is given, includes the whole capital outlay, for roadway, buildings, cars, locomotives, etc. etc. The pound sterling has been taken at* $4 84.

Liverpool and Manchester.

Cost up to the 30th of June, 1840, $6,810,717, of which $3,726,195 is in stock, and the remainder has been raised by loans.

The length of the road is $30\frac{66}{100}$ miles.
The cost per mile has been $ 222,137.
The whole capital of the company, on the 30th of June, 1840, including some items not properly chargeable to roadway and works, was $ 6,847,665. The earnings for the previous six months were at the rate of $8\frac{4}{10}$ per cent. on this capital, per annum. Wherever the dividends exceed 10 per cent. per annum, the tolls are by law to be reduced.
There are three tunnels at Liverpool, the aggregate length of which amounts to 4506 yards, and which have cost more than $ 1,500,000.

Stockton and Darlington.

Cost $ 1,210,000: viz. stock $ 736,000, and loans $ 484,000.
Length of the main line, 25.38 miles.
Four short branches, 12.75 "

Total, 38.13 "

The cost per mile, including the branches, has been $ 31,733. The dividends are £14 per each £100 share per annum, of which £10 per cent. is divided among the stockholders, and £4 per cent. is retained as a sinking fund. This road and its branches are used chiefly for the transportation of coal. Locomotive engines run on 24 miles; the remainder being worked by stationary engines and horse power.

Grand Junction.

The cost to the 30th of June, 1839, was $ 9,300,000.
Length (from Birmingham to Newton,) $82\frac{63}{100}$ miles.
Cost per mile, $ 112,550.
The whole amount of the company's stock at the present time, (all in shares or parts of shares,) including the cost of branches is $ 10,664,335.
The net profits, during the years 1838 and 1839, were $8\frac{6}{10}$ per cent. per annum.

London and Birmingham.

The cost to the 30th of June, 1840, was $ 27,580,135, viz: stock, $ 15,125,000, and loans, $ 12,455,135.
The length of the road is 112¼ miles.
The cost per mile has been, $ 245,702.
This road yields a profit of about 9 per cent. per annum, on the paid up capital. The gross income for the year ending 30th June, 1840, was $ 3,326,583, of which the receipts from passengers alone, were $ 2,446,518. The cost of land has been $ 30,000 per mile.

London and Southwestern, (or London and Southampton.)

Cost, $ 9,943,228, viz: in shares, $ 6,776,000; in loans, $ 3,167,228.
Length, $76\frac{7}{10}$ miles.
Cost per mile, $ 129,639.

Great Western.

This road is not yet completed. The amount expended up to the 30th of June, 1840, was $ 21,819,494.

The whole length of the road will be $117\frac{4}{10}$ miles, of which 75 miles are now in use, viz: 63 miles at the London end and 12 miles at the Bristol end.

It is estimated that this road will cost upwards of £ 50,000 per mile, say upwards of $ 242,000.

The average number of passengers per day, on the London end of the line, for the last two and a half years, has been upwards of 1500. Up to the 30th of June, 1840, the amount paid for lands and expenses relating thereto, was $ 3,475,449, being at the rate of more than $ 2,420 per acre, or $ 29,000 per mile.

Newcastle and Carlisle.

Probable cost, $ 4,598,000, that being the amount authorized by parliament to be raised. Of this there is in stock, about $ 2,613,600 the remainder having been raised by loans.

The length of the road is $61\frac{83}{100}$ miles.

The cost per mile has been $ 74,360.

Railway Property as an Investment.

"A correspondent calls our attention to the extraordinary increase in the value of railway property, which has taken place within the last six months. Comparing the quotations in our share list of the 14th of December last, with those of the 13th inst., it will be seen that upon twenty lines this increase amounts to upwards of *eight millions sterling!* Thus the Great Western shares in that period have risen 52*l.* per share, namely, from 10 discount to 42 premium, equal to 1,300,000*l.* upon 25,000 original shares; the new shares have risen from 5 discount to 20 premium, equal to 625,000*l.*—making altogether 1,925,000*l.* upon the old and new shares. The London and Birmingham shares have in like manner risen from 50 premium to 99 premium, equal to 1,225,000*l.* upon the 25,000 original shares; the quarter shares have risen from 22 to 30 premium, equal to 200,000*l.*; and the new shares have risen 13*l.*, equal to 405,950*l.*; making altogether upon the shares a sum of 1,830,950*l.* The shares of the other lines in the following table, are computed in the same manner:

Great Western, - - - -	£1,925,000
London and Birmingham, - - -	1,830,950
Grand Junction, - - - -	829,000
London and Southwestern, - - -	612,000
Eastern Counties, - - - -	488,000
North Midland, - - - -	420,000
London and Brighton, - - - -	360,000
Manchester and Leeds, - - - -	312,000
Midland Counties, - - - -	240,000

Manchester and Birmingham, - -	180,000
London and Croydon, - - - -	165,000
Great North of England, - - -	150,000
London and Blackwall, - - -	120,000
York and North Midland, - - -	120,000
Birmingham and Gloucester, - -	95,000
Chester and Crewe, - - - -	90,000
Bristol and Exeter, - - -	90,000
Cheltenham and Great Western, - -	75,000
Birmingham and Derby, - - -	63,000
London and Greenwich, - - -	60,000
	£ 8,224,959

These results cannot fail, as our correspondent remarks, to be most gratifying to Railway proprietors, as showing that public opinion has undergone a change; that railways are no longer viewed with suspicion as the mere speculation of a day, to be spoken of in the same breath with Spanish bonds, &c., but that they are regarded as real and valuable investments in the soil."—*Railway Times.*

Dangers of Railroad Traveling.

"It is ascertained by experiment, that the danger of loss of life on an average railroad trip is about 1 to 4,000,000. The following data on which this conclusion is founded, are copied from a late British publication:

Name of Railway.	*No. of Miles.*	*No. of Pas.*	*No. of Accidents.*
London and Birmingham,	19,119,465	541,360	3 cases of contusions, no deaths, (1)
Grand Junction,	97½*	214,064	2 cases of slight do, (2)
Bolton and Leigh and Kenyon and Leigh,	3,923,012	508,763	2 deaths, 3 slight contusions, (3)
Newcastle and Carlisle,	61*	8,540,759	5 death, four fractures, (4)
Edinburgh and Dalkieth,	8*	1,557,612	one arm broken,
Stockton and Darlington,	2,213,681	357,205	none.
Great Western,	4,100,538	230,408	none.
Liverpool and Manchester,	31*	3,521,820	8 deaths, no fractures, (5)
Dublin and Kingston,	6*	26,410,152	5 deaths and contusions to pas'gers,
London and Greenwich,	484,000	2,880,417	one passenger slightly bruised.

* Length of road.

(1) None of these accidents occurred to actual passengers.

(2) None of these accidents occurred to actual passengers.

(3) None of the persons killed were passengers.

(4) One of the persons killed was a passenger.

(5) The whole of these were passengers; one of them a sergeant in charge of a deserter, who jumped off the carriage whilst in motion; the sergeant jumped after him to retake him, but was so much injured that he died; three others got out and walked on the road and were killed; the rest suffered by collisions of two trains, at different times. These include all the casualties from the very commencement of the working of the line."

(NOTE F.)

Statement of the cost, annual expenditures, receipts, etc., of several railways in the United States.

Name of Road.	Length in miles.	Total cost.	Expenses per annum.	Receipts per annum.	Profits per annum.	Per centage of profit.	Number of through passengers.	Number of way passengers.	Total number of passengers
Utica and Syracuse, July, 1839, to July, 1840.	53	941,475	65,648	197,923	132,275	14	74,034	55,802	129,836
Utica and Schenectady, 1839,	78	1,855,052	119,630	400,671	281,041	15	95,776	86,823	182,599
Boston and Lowell, 1839,	26¼	1,668,476	92,151	241,209	149,068	9	130,000		
Boston and Providence, 1839,	41	1,582,000	194,411	313,907	119,496	7	130,000		
Boston and Worcester, 1839,	44	1,848,085	126,384	231,807	105,423	6	90,000		
Camden and Amboy, 1839.	61	3,220,857	258,043	685,329	427,286	13¼			181,479
Philadelphia, Wilmington and Baltimore, 1839.	97	4,379,225	169,130	490,635	321,505	7¼			213,650

NOTE.—The whole number of passengers on the Boston and Lowell, Boston and Providence, and Boston and Worcester roads, are reduced to through passengers.

In the cost of the Camden and Amboy road, the cost of steamboats and some other matters are included, and the expenses and earnings of the boats at the ends of the road are also included in the statement.

Mechanics' Register.

LIST OF AMERICAN PATENTS WHICH ISSUED IN APRIL, 1840.

With Remarks and Exemplifications by the Editor.

1. For a mode of *Oiling and Protecting Mill Spindles from dirt;* Jesse Hubbard, Watertown, Connecticut, April 8.

A collar attached to the upper side of the bush, fits into a groove in the under side of the driver, so that neither meal nor any kind of dirt can reach the spindles; for this purpose the middle part of the driver is made larger than usual to admit of forming a groove of sufficient diameter to receive the collar on the bush, and of course of greater diameter than the spindle. An oil hole, or tube, passes down through the whole length of the damsel, the bail and the driver; so as to discharge the oil where the spindle bears against the bush.

The patentee says, "what I claim as my invention, and desire to secure by letters patent, is the mode of protecting the spindle of the mill from meal and dirt, by means of the protection collar and groove, and of oiling the spindles by means of a hole through the damsel, bail and driver, as specified." In all of which there is but little novelty, the same end having been before attained by means very nearly resembling that which is the subject of the foregoing patent.

2. For improvements in the machine for *Making Bricks from Dry Clay;* Samuel Talbot, Richmond, Henrico county, Virginia, April 8.

Three, or more, moulds are made, in depth greater than the thick-

ness of the brick when pressed, and placed horizontally. The pistons for pressing are attached to a plate which is suspended by connecting rods to one end of a lever, and the plate is kept parallel with the surface of the moulds by means of two guide rods. The bottoms of the moulds, or "dischargers," are made similar to the pistons, and from the bottom of the plate, to which they are attached, descends a rod which answers as a guide to the motion of the plate, the lower end of which rod is connected to one end of a lever, passing under the machine. There is a table on each side of, and on a level with, the top of the moulds on which slides a discharger, which is simply a box without top or bottom, made to slide accurately by means of guides on each side, and this is connected by a rod to one end of a lever which vibrates horizontally, being actuated by cams on each side of a wheel acting on the other end of the lever which is forked for that purpose. The charger contains a sufficient quantity of dry clay for forming three bricks; when the charger is pushed over the moulds the clay drops into them, and it is then withdrawn. The pistons descend, press the brick, and the dischargers, or bottoms of the mould, then force up the bricks which carry up the pistons with them.

The lever which works the pistons, and that which works the dischargers are both operated by cams on the shaft of the cam wheel which works the charger.

The claim is to "the mode of producing the pressure on the pistons, by means of the lever operated by the cam, in combination with the mode of operating the dischargers; and also in combination with the foregoing, the mode of operating the box, or charger, and removing the bricks by the same."

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3. For an improvement in the manner of constructing *Stoves for Heating Apartments;* John Scott, Philadelphia, Pennsylvania, April 8.

This stove has an upright furnace, on the top of which is placed a drum, the upper part of the furnace passing through the cylindrical part of the drum and projecting some distance within it. The furnace is surrounded by a casing provided with holes for the admission of cold air which circulates around the furnace, becomes highly heated, and passes into the drum, through openings in which it is discharged into the room. A door is made in the cylindrical part of the drum for the supply of coal, which is thrown into a hopper. This hopper is connected with the furnace by a pipe, and a sliding valve is placed at the junction of the pipe and hopper, so that by closing the valve the coal can be thrown into the hopper without allowing the gas and dust to escape into the room; after the door has been closed the valve is opened and the coal falls into the furnace. A pipe passes through one end of the hopper and one end of the drum into the chimney flue. The object, as stated by the patentee, is to increase the radiating surface; to radiate the heat downwards so as to warm the feet of the persons sitting near, and to prevent the entrance of dust and dirt into the room. The patentee says, "I claim as my invention in the above

described stove, the manner in which I have combined and arranged the hopper, the drum and the furnace, as described."

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4. For a *Self Regulating and Oiling Mill Bush;* Samuel Moore, Borough of Chambersburg, Franklin county, Pennsylvania, April 8.

The exterior case of the bush is made of cast iron, is hollow, in form of a cross, and is let into the stone; through the centre of this case passes the mill spindle, the collar of which works between, and is sustained by, four brass boxes, one in each arm of the cross. These boxes are hollow and have two concave faces, so that when one is worn the other can be used by turning the box. The oil is supplied by means of a wick, or other fibrous material, which dips into the oil contained in the boxes, passes through a hole in the upper part of said boxes, and is brought into contact with the collar of the spindle, thus supplying the oil by capillary attraction. The boxes are borne up against the spindle by means of a spring acting on the back of each; and the tension of the spring is regulated by a nut working on a screw attached to the end of each arm of the cross, and passing loosely through a hole in the middle of the spring. The claim is to the manner in which the double faced brass boxes, or oil cups, are arranged and combined with the nuts, studs, and springs, so as to operate upon the spindle in the manner described.

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5. For an improvement in the manner of constructing the *Chairs for Railroads;* William Dripps, Coatsville, Chester county, Pennsylvania, April 8.

(See specification.)

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6. For an improved *Combined Mouldboard Plough;* Jonathan Knodle, Bakersville, Washington county, Maryland, April 8.

The disclaimer and claim accompanying the specification of this patent, will give a sufficiently clear idea of this improvement, viz: "I am aware that two or more ploughs have been combined together in the same frame, and I do not therefore make any claim to a combination as heretofore made. But what I do claim is the using of several mouldboards of cast-iron, of the ordinary construction of such mouldboards, but without land-sides; and the so arranging said mouldboards as that the point of either of those in the rear shall follow that which precedes it within the width of its furrow slice, in the manner and for the purpose herein set forth."

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7. For improvements in *Guns, Pistols, and other Fire Arms;* George Stocker and Joseph Bently, Birmingham, England, April 8, 1841.

There are three items claimed as improvements in this patent. The first is an explosion chamber within the breech, or solid "break-off," so that what flies off in the explosion of the cap shall not escape from said chamber. It is applied to guns in which the nipple is placed in

the back of the breech, the axis of the nipple being in a line with the axis of the barrel. This chamber is covered by a hinged plate which can be opened to place the cap on the nipple, &c. The second consists in a peculiar construction of the cock, which passes through the bottom plate and forms a handle in front of the trigger, and within the guard, the pins on which the cock works passing through two cheeks projecting from the trigger plate. To cock the gun, the lever of the cock is pushed towards the muzzle, and in a direction contrary to that of the motion of the trigger in discharging the gun. The third claim is to a mode of connecting the break-off, and the cock, and trigger plate, by means of a screw which passes through the break-off and screws into a piece of metal that projects from the inner side of the cock and trigger plate, thus embracing the stock. The trigger plate is provided with the usual screws in addition to that described.

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8. For improvements on *Harness for a Draft Horse;* Abel Post, Henrietta, Monroe county, New York, April 8.

These improvements are on that kind of harness in which the horse pulls by a strap passing around the breast, instead of by the collar around the neck, and consists simply, as the inventor states, "in forming a clasp, or hook, in the front of a *common breast collar* so that it can be separated there, to be taken off the horse; and also in substituting hames and pads in the place of the usual neck strap in the common English breast collar, so as to make the holding back easy for a horse." The claim is confined to the two devices above named.

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9. For improvements on the *Platform Balance;* Chauncey Crain and Evert L. Wemple, Madison, New York, April 8.

The rod which connects the platform lever with the steelyard beam is jointed, near its upper end, to a horizontal lever running under and jointed to the frame work of the steelyard. This lever is provided with a sliding weight regulated by a thumb screw passing through it and working in two pendants. By screwing the weight nearer to, or farther from, the connecting rod, the balance can be adjusted with the greatest accuracy. The same thing has been effected heretofore by having such a sliding weight attached to the steelyard beam.

Another improvement claimed is in substituting for the notches on the steelyard beam, a sliding clasp to which the weight is suspended. This clasp straddles the beam, and has two pointers, one on each side, to indicate the amount of weight.

The patentees say, "what we claim as our invention, and desire to secure by letters patent, is the method of balancing the levers by means of the weight suspended from the lever, between the pendants, and adjusted by the screw, as described. We claim also, the providing of the graduated lever with a clasp to which the movable weight is attached, with pointers to indicate, by the lines on the lever, the amount of weight on the platform."

10. **For constructing and affixing the *Ribs of Cotton Gins;*** Asa Copeland, Jr., Bridgewater, Plymouth county, Massachusetts, April 8. (See specification.)

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11. **For improvements in machinery for operating the friction *Brakes of Railroad Cars;*** John L. Clarke, Nashua, Hillsborough county, New Hampshire, April 11.

The brakes are of the usual construction, and are worked by a lever, one end of which is attached to the middle of the rod that runs across the car frame from one set of brakes to the other; the other end being attached to a double set of toggle joint levers suspended from the frame of the car. As the double toggle spreads, it relieves the brakes, and when it is straightened it forces them against the wheels. This working of the double toggle joint levers is effected by a sliding rod running through the whole length of the car and provided with two flanches or collars, one on each side, so that when the rod slides one way one of the flanches acts on one of the toggle joint levers and straightens it, and when it slides the other way the other flanch acts on the other toggle. The length of the rod in each car is so regulated that the bumpers can come together without bringing the ends of the rods into contact; but when the rod of the tender is forced back by the attendant, which is effected by a lever attached to the rod and passing through the floor, and the motion of the tender is arrested by the brakes, it comes in contact with the rod in the next car and forces it back, and so on from car to car until the whole train is affected. The forcing of the rod back carries the brakes up to the wheels and thus arrests the motion of the cars. The brake of the tender is worked in the usual way, and is so arranged as that it also can be worked by the arrangement before described. In this case the toggle used on the tender is single, and is embraced by a collar and slides freely on the rod, which is provided with a catch-dog hinged to it, and when the rod is forced back far enough the catch of the lever embraces the sliding collar and brings the toggle into play. The brakes can be acted upon either by a lever worked by the fireman or attendant, or by the momentum of the cars.

Claim.—"First, I claim arresting or retarding the progress of cars while in motion on a railway by a combination of rods connected with the friction brakes, by the intervention of toggles or progressive levers, transverse beam, or other suitable machinery, the whole arranged and operating by the momentum or power applied to the lever, substantially in the manner and on the principles herein described. Second, the method of connecting the rod of the tender and toggle by means of the combination of machinery, consisting of the dog, or catch, attached to the rod, piece of metal (sliding collar) shaped and arranged together, and acting in connexion with the levers, substantially as above described, for the purpose of operating the brakes by the momentum of the cars whenever the same may be necessary or desirable."

12. For a machine for *Cleansing and Washing Yarn and other Substances;* Sands Olcott, city of Philadelphia, Pennsylvania, April 11.

This machine consists of a series of fluted rollers, moving with equal velocity. The upper one of each set works within flanches on the under one, and receives motion from it by being pressed down in a manner similar to that of the draw rollers of a spinning machine. The yarn, or other substance, to be washed and cleansed is made into a skein or endless belt; a portion of it hangs in water, or other detergent, contained in a vat, whilst the rest is passing under the series of rollers; a roller is placed at the bottom of the vat, and around this the skein passes for the purpose of properly guiding it.

The patentee says, "what I claim as my invention, and desire to secure by letters patent, is the construction of a machine for washing yarn and other substances by means of a series of pairs of fluted rollers, with flanches on one of each pair, in combination with the reservoir and trough, so that an endless skein can be passed continually through them, and at the same time be passing through the water or other liquid, for washing, as herein described."

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13. For a machine for *Reducing the Fibres of Flax and Hemp;* Sands Olcott, city of Philadelphia, Pennsylvania, April 11.

A cylinder provided with a series of circular saws, or teeth, like those of a cotton gin, revolves in a frame and has a revolving fan below it to clean the teeth of the saws. The fibres to be reduced are carried up to the saws by a series of cords which pass around a roller at each end of the frame and under a grooved roller above the saws. The last named roller has a groove for each saw and one for each cord. The claim is to "the combination of the gang of saws, or rows of teeth, on a cylinder, with the arrangement of cords and rollers for holding, guiding and working the flax and hemp, in the manner described."

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14. For a *Floating Swing Bridge;* John N. Vrooman, Danube, Herkimer county, New York, April 15.

One end of this bridge is attached, by means of a *pivot*, to a frame on the side of a canal, or other stream, whilst its other end is attached to a scow, boat, or buoy, and floats upon the water. When the bridge is floated into place for passage, it rises several inches above the frame built out from the bank. Why it is made to float so high is not stated, but we suppose that it is intended to provide against the inconvenience of low water, and to prevent the friction which would be consequent upon the dragging of such a weight on to the frame which receives it. It is stated that the bridge can be raised, in case of low water, by means of slides, screws, &c., by arrangements well known to mechanics, and which, therefore, need not be described. The swinging end of the bridge is connected with both shores, by means of ropes, so arranged that it can be opened from either; and it

is also provided with a latch to prevent it from swinging open except when desired. The ropes are so connected with the latch that it can be disengaged therefrom from the off shore.

The patentee says, "what I claim as my invention, and desire to secure by letters patent, is the employment of a boat, scow, float, or buoy, for the purpose of sustaining the swinging end of the bridge in the manner described. I also claim the arrangement of ropes, or chains, by which the bridge can be opened or closed from either side of the canal or stream, as described, and in combination therewith the latch for retaining the bridge in its place when thrown back."

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15. For *Oiling Horizontal Shafts and Axles;* Hiram M. Smith, city of Richmond, Virginia, April 15.

Oil is to be supplied to the gudgeon, or gudgeons, of a shaft by means of a wheel which revolves in a reservoir of this fluid attached to the lower box of the gudgeon. The wheel has its bearings in a sliding frame, resting upon a spring which bears it up to the gudgeon of the shaft. The lower box being pierced to allow the wheel to come in contact with the gudgeon; this box is provided with a gutter on each side of the gudgeon to catch the oil, which runs back into the reservoir through a hole made for that purpose. A scraper, or wiper, is attached to the sliding frame of the wheel to wipe off, or remove, the surplus oil.

The patentee says, "what I claim as my invention, and desire to secure by letters patent, is the wheel working in an oil cup, and a sliding frame, or gate, acted upon by a spring which adapts it to any irregularity of height the bearing is subject to, as herein described. I disclaim it as a friction roller, as I do not intend it to support the bearing, but merely to act as an oiler or feeder. I also claim the wiper and the gutters on each side of the bearing in combination with the wheel as herein described."

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16. For an improvement in *Swages or Dies for making Screw Augers;* William Field, Pawtucket, Providence county, Rhode Island, April 15.

There are two swages, or dies, which when put together form the matrix of a little more than the half of one twist of the augur. The metal is prepared by making it into a flat bar on the part to be twisted, with a round part above the twist. The swages are worked in any manner known to workmen, such as tilt or trip hammers, &c. That part of the swage or die which forms the thread in one half of said die, should extend some distance into the other half. As the dies are operated upon, the bar of metal should be turned round. It will be obvious that the flat bar will thus be twisted section by section until the whole twist be completed. The claim is to the forming the twist in screw augurs by means of the swages or dies constructed as described.

17. For an improvement in the *Cheese Press;* Rufus Porter, Billerica, Middlesex county, Massachusetts, April 15.

The design in this press is to produce the required pressure by the weight of the cheese which is being pressed. The board upon which the cheese is placed, and the one above it which gives the pressure, are attached to end pieces that slide upon each other and on the vertical sides or posts of the main frame. The side pieces of the boards slide upon each other to allow them to come close together, or to recede from each other. At each side two levers are arranged with their fulcra in the side pieces of the upper board, and act against the side pieces of the bottom board. These levers are bent upwards, and are united at their upper ends by the axis of a roller which bears against the outer edge of the posts of the frame that are swelled out, being much wider at the base than at the top. Thus it will be seen that when the cheese or other weight is placed on the bottom board it descends, and as it descends the rollers on the ends of the double levers are forced out by the swell on the outer edge of the posts, throwing out the upper ends of the levers, and thus compelling the two boards to approach each other. The claim is confined to "the mode of producing a pressure by means of the double levers, friction rollers, and swelled posts, as described." There have been two or three patents previously granted for causing the cheese to be pressed to operate by its own weight in producing the pressure, but under an arrangement of the respective parts different from that above described.

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18. For an improvement in the manner of constructing *Bee-Hives;* Martin Engel, of the borough of Easton, Pennsylvania, April 15.

The specification of this patent is of considerable length, and the drawings numerous; and as nothing short of a full description and representation would give any adequate idea of the construction of this hive, we must forego the attempt in the narrow limits of a notice.

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19. For improvements in *Tailors' Measuring Instruments;* William I. Lemmond, Lancasterville, South Carolina, April 18.

As we are not particularly acquainted with the art of measuring the human figure for the purpose of cutting garments, we will dismiss this article by quoting that part of the specification which expresses the nature of the invention, together with the claim, viz: "The nature of my invention consists in the combination of a horizontal graduated sliding strap, having graduated vertical sliding straps upon it, with tape measures attached to them with a graduated vertical strap. And also the combination of a graduated horizontal strap, having vertical sliding pieces with tape measures attached to them, with the vertical strap."

"What I claim as my invention, and which I desire to secure by letters patent, consists in the combination of the horizontal graduated sliding strap, having graduated vertical sliding straps upon it with

tape measures attached to them, with the graduated vertical strap; and also the combination of the graduated horizontal strap, having vertical sliding pieces with tape measures attached to them, with the vertical strap."

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20. For a method of *Measuring the Body and Drafting Garments;* Isaiah J. Hendrix, Troy, Rensselaer county, New York, April 18.

The remarks made upon the preceding patent will apply to this. The patentee says—"The nature of my invention consists in the use of a flexible square applied to the body of the person to be measured, and also in the use of a protractor likewise applied to the body of the person to be measured, each and together furnishing, when properly applied, sufficient data to govern the mechanic in the correct cutting of a garment more easily and correctly to fit the varieties of form and persons, enabling the mechanic to take measures and note them down so that they can be applied to the cloth precisely as they are taken on the person, as the skilful surveyor delineates a map from the minutes which he has taken of the survey of an uneven surface." "What I claim as my invention and desire to secure by letters patent, is the mode of obtaining the backward or forward location of the shoulder strap and pitch of the shoulder seam by means of a flexible square and protractor, applied and used in the manner described."

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21. For improvements in the *Construction of Railroads;* James Herron, Baltimore, Maryland, April 18.

The first improvement is fully explained in the first section of the claim, which is in the following words, viz:—"What I claim as my invention, and desire to secure by letters patent, is, 1st. Placing the sills in the formation of a railway, so that they will cross each other in lines diagonal to the rails; and uniting them with each other and with the rails, so that they become struts and tie braces to the track, substantially, as described. And whereas said brace sills may be variously combined with each other, and with cross sills, and may be made to support an iron rail without the intervention of the timber string pieces; and may also, like common sills, be placed on a 'mud sill.' I distinctly claim to be the inventor of the *braced sill* or *latticed construction* of railway tracks under the modifications set forth, together with such variations thereof as may produce a like result by means substantially the same. I thus by the union in one, to an indefinite extent, of such materials as those that usually compose railway tracks, obtain by a united framing a more extensive and uniform bearing on the soil than the individual parts would have; all other railways having to depend upon the uniformity of soil, or artificial road-beds, for their evenness of surface. Whereas my railway track is independent in its formation of the soil on which it rests."

The second improvement consists in a mode of uniting or scarfing the string pieces, so that where the ends are put together they cannot

separate from each other except lengthwise, and the claim is to this peculiar mode of scarfing, which could not be understood without diagrams. The third improvement is for a mode of holding the iron rails by means of a spring, which presses the ends of two rails against the chair to prevent vibration, and at the same time permits them to slide lengthwise when expanding or contracting, which is effected by making the bolt which passes through the rail and chair with a double spring instead of a head, which thus holds the ends of the two rails; or by making a wrought iron chair, with ears on each side, that are bent over the web or seat of the rails, when laying them down. The claim is to the "method of evenly joining, and holding railway bars by means of a *metallic spring pressure*, so as to permit the contractile and expansive motion of the railway bar, whether said spring pressure operates by means of my malleable iron chairs, or as it may be variously modified and united with cast iron chairs, as described. The application of a spring to the rail for the purpose described being in itself new, and as said spring may be variously applied for producing the intended effect, it is to be understood that I claim the employment of a spring under the various modifications thereof described, and whenever it operates upon the principle and produces the effect in the manner set forth."

The fourth and last improvement is for a mode of holding the iron rails at the "middle of their lengths" by means of a piece of iron lying across the string, having two wrought iron ears which are bent over the web or base of the T rail, and being attached to the string by means of an iron strap screwed to the ends thereof, and passing under the string, or keyed under it. Or effecting the same thing by key bolts passing through the strings and the web or base of the T rail, by which mode "the iron rail is made to support the scarf of the string pieces or to form a part of the splice." The claim is to the mode of holding the rails at the middle of their lengths, as set forth.

We will only remark that the plan of construction proposed in this patent has been the subject of high commendation by some of our best practical engineers.

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22. For improved machinery for *Manufacturing stuffs in which the fibres of various materials are united with adhesive substances;* Thomas R. Williams, a citizen of the United States, now residing in England, April 24.

This invention consists of a new arrangement of machinery, by means of which all kinds of fibrous materials, such as cotton, silk, flax, hemp, tow, fur, wool, hair, &c. are combined, with adhesive compositions, into manufactured articles which may be applied to the purposes for which paper, pasteboard, millboard, papier maché, parchment, vellum, leather, woven fabrics, felt, floorcloth, tarpaulin and skins of animals are used.

A cylinder covered with wire gauze, &c. revolves in a case in which the fibres are suspended by a current of air, generated by a fan revolving in a case connected with the cylinder, which is so

arranged, by means of partitions, that the partial vacuum generated by the fan can only be supplied by the passage of air through the wire gauze covering of that half of the cylinder which, in its revolution, is above a horizontal line passing through the shaft. This current of air carries and deposites the fibres on the cylinder as it revolves, thus making a sheet, or batt, continuously, which is carried off between two pressing rollers. It is then carried between two rollers which apply the adhesive compound. The under roller revolves in a trough containing the melted compound, and carries up a sufficient quantity to apply to the under side of the batt, and the trough which applies the compound to the upper side is situated at the side of the upper roller so as to deliver the compound directly on to the batt. The rollers are kept hot by heaters, or in any other manner, and the upper one is weighted so as to press out the surplus of the composition and compress the batt.

The adhesive composition used in this part of the apparatus may be made of about three parts of pitch or rosin, with about one part of tar, to which add perhaps a thirtieth of oil or tallow, but the proportions necessarily vary for the different purposes for which it may be intended."

After the batt or sheet has passed through this apparatus, it may be cut and dried for use, or be carried through another composition consisting of weak size, mixed with paste and clay in different proportions, contained in a vat, and this is to be done by passing it over and under a series of rollers immersed in the compound, and then between two pressing rollers.

"The patentee says:—"I do not claim the forming of a batt or sheet from fibrous materials in the manner set forth, nor do I claim the machinery employed for the saturating of such a batt or sheet of fibrous materials with resinous and other substances; but what I do claim as of my invention and desire to secure by letters patent, is the so combining and arranging the machinery employed substantially in the manner herein set forth, as that the processes of forming the batt and of saturating the same with the different compounds shall be simultaneously and consecutively effected so as to form sheets or lengths of fibrous materials applicable to various purposes."

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23. For improvements in the machine for *Crushing Hard Substances:* James Rowe, Athens, Limestone county, Alabama, April 24.

This patent has been granted for alleged improvements on a machine long known, and used for crushing lime and other substances in preparing mortar, cement, &c., which machine consists of two wheels working on the ends of a beam attached to a vertical shaft, the wheels running in a circular trough surrounding the shaft.

The first improvement consists in a mode or modes by which the turning of the wheels is insured, either by making indentations on the peripheries of the wheels, into which fit knobs or projections made in the bottom of the trough, or by placing a cog-wheel on the shaft of each crushing wheel, which mashes into cogs made on the

outside of the trough. The second improvement is for applying weight to the wheels by balancing the beam in a mortise passing through the shaft, and having the shaft to rest upon the pin on which the beam is balanced, so that any weight applied to the upper gudgeon of the shaft by a weighted lever will of necessity be transferred to the wheels, and cause them to crush substances which could not be affected simply by the weight of the wheels. The claim is, first, to the "mode of preventing the grinding" (or crushing) "wheels from slipping by means of the cog gearing, or by cross projections and indentations of the valley, (trough), together with cuts, cogs, or notches on the tread of the wheels. And second, to the method of applying the weight of the centre revolving shaft, or any additional weight which may be applied thereto, to the grinding, or crushing, wheels by making the shaft bear upon the vibrating (balance) beam to which the wheels are attached, as described."

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24. For improvements in the *Power Loom*, so as to adapt it to the weaving of counterpanes; Erastus B. Bigelow, Lancaster, Worcester county, Massachusetts, April 24.

(See specification.)

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25. For *Constructing and Cording Bedsteads;* Martin Engel, of the Borough of Easton, Northampton county, Pennsylvania, April 24.

This bedstead is put together with round tenons, those on the end rails being longer than usual, and those on the side rails being provided with a pin projecting from the end of each, which passes into a hole made in those of the end rails. The end rails are round, and inside of the foot rail there is a roller having its gudgeons working in the side rails; and on the inside of the head rail there is another roller not provided with gudgeons but working freely within the side rails; to this roller a windlass is connected by means of straps which wind around it. The cord is in one piece, and one of its ends is attached to the roller inside of the head rail; from thence it passes over the head rail, then over the foot rail, around the roller within the foot rail, back over the foot rail, over the head rail, and around the roller within the head rail, and so on until the whole of the cord is taken up and the space within the rails corded. The cord is tightened by turning the windlass which winds up the straps, connecting it with the roller, next to the head rail, and draws it up, and thereby stretches the cord. The claim is to the above manner of connecting the rails, and to the mode of cording.

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26. For an improved mode of making *Metallic Heddles for Looms;* Charles Strong, Hartford, Windsor county, Vermont, April 24.

These heddles are made of narrow strips of tinned sheet iron, or other metal, having a hole made at each end to slip on to wires at the top and bottom of the frame. The eyelet hole is made by bending out the metal and then taking another piece of the same material

longer than the bent part, bent in a similar manner, and soldering the two together above and below the bent parts, thus leaving an opening sufficiently large to receive the thread. The selvage heddles are made in the same manner except that the eyelet holes are larger. For making highly sleyed cloths the heddles are arranged in two rows so as to bring the thread closer together, and for that purpose there are two wires at the top, and two at the bottom of the heddle frame, that the set of heddles on one wire shall come in a line with the space between the other set. The patentee disclaims the mere making of metallic heddles, and confines his claim to "the method of making the eyelet holes in the common and listing heddles, as described; and also to the method of arranging the metallic heddles in two rows instead of one, by which arrangement higher sleyed cloths may be woven by the metallic heddles than without that arrangement, as described."

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27. For improvements in the machinery for *Making Rivets;* Oliver Edes and Andrew Holmes, Braintree, Norfolk county, Massachusetts, April 24.

The claim refers throughout to the drawings and could not be understood without them, we will therefore merely attempt to give a general idea of the improvements claimed.

The first improvement consists in the construction of the cutting apparatus, the dies of which are semi-circular, so that in the operation of cutting the wire shall not be flattened, there being a standard, or gauge, against which the wire is forced by the operator to regulate the length of the rivet. The second is in the combination of the moving cutter, which separates the blank from the rod, with a spring arm for "pinching, or nipping, the piece of wire separated by the cutters, and conveying it downwards to the aperture" of the leading apparatus; and also in the arrangement of parts which withdraw the arm above mentioned from the blank after it has been carried to the heading apparatus. The third is in the combination of levers, &c., for forcing, or pushing, out the rivet from the aperture after the heading machinery has performed its office.

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28. For a *Movable Loading Muzzle for Rifles;* Alvan Clark, Cambridge, Middlesex county, Massachusetts, April 24.

The object of this improvement is to facilitate the loading of the rifle and to preserve the calibre of precisely the same diameter to the very point of delivery of the ball, and this is to be effected by means of what the inventor calls a "movable loading muzzle," which is put on to the end of the barrel for loading, and removed when the rifle is to be fired. The bore of this loading muzzle, where it meets the barrel, is of the same diameter with it, and is enlarged towards the mouth so as to receive the ball with ease, and gradually prepare it to be received by the barrel. The rifling of the barrel and muzzle should correspond. The muzzle may be fitted on by means of pins projecting

from it and fitting into holes made for that purpose in the end of the barrel. The claim is confined to this device.

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29. For improvements in the *Braiding Machine*, by which it is adapted to the braiding of Manilla or Sisal hemp; Elisha Fitzgerald, New York city, April 24.

This patent was granted for improvements on the ordinary braiding machine, in which the "bobbin carrier" travel a serpentine course around what is called a "pot." In this machine the double serpentine course only reaches around two thirds of the circumference of the pot, and after the bobbins have traveled to one end they return, and thus go from end to end interlacing the fibres or threads, and the improvements claimed consist, first, of two draw rollers, one of which has a continuous motion and the other pressing upon and receiving motion from it, which rollers receive and draw the braid, as it is made, from an eye-plate, so called because it has an eye through which the braid passes; this is placed above the machine, but in a line with the vertical axis of the pot. As the threads pass from the bobbins to the eye of the eye-plate, they, by being carried around and interlacing, form the braid; but to insure the proper formation of the selvages or edges of the braid, a circular guide plate is used on each side of the eye-plate, the centre of each of which is in a line with the eye and the centre of the circle around which the bobbins travel, in returning after they have reached the end of their circuit. The threads are carried around these guide plates and insure the proper formation of the selvages.

The claim is confined to the employment of the circular guide plates, and to the combination of the draw rollers with the spools, guide plates, and eye-plates, as described.

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30. For a *Corn Sheller;* Peter A. Gladwin, Chester, Middlesex county, Connecticut, April 24.

This corn sheller is an improvement on one patented to Lester E. Denison, and noticed in vol. xxvi of this Journal, page 160; it consists of what the patentee terms a "carrying cylinder," made of strips attached to two heads, the spaces between the strips are sufficiently large to receive an ear of corn of the largest size. A spring bottom is placed in each of these spaces for the purpose of pressing the ears of corn contained in them, against the concave, which consists of a series of shelling cylinders. As the carrying cylinder revolves, it brings each ear against the successive shelling cylinders. The shelling cylinders are made to revolve by a cog wheel on the shaft of the carrying cylinder which mashes into a pinion on the shaft of each of the shelling cylinders.

The claim is to "the forming of the concave with a number of shelling rollers arranged in the manner described, and also to the arrangement of the spring beds in the carrying cylinder instead of the concave."

In the machine patented to Lester E. Denison, a large shelling

cylinder revolves within the carrying cylinder, and the ears are forced against it by the spring concave.

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31. For an improvement in *Steam Boilers;* John Penniman, city of Baltimore, Maryland, April 24.

We will merely quote the claim appended to the specification as it gives a sufficiently clear idea of the improvement to bring it within the comprehension of any one, viz: "Having thus fully described the nature of my improvement, and the manner in which I carry the same into operation, what I claim therein as my invention, and desire to secure by letters patent, is the placing a series of circulating tubes on the front plate of the boiler, in such a manner as that they shall, at their lower ends, communicate with the water in the lower part of the boiler, and at their upper ends with the water in said boiler a little below the water line, whilst they are, along their whole length, exposed to the direct action of the heat in the fire box, in the manner and for the purpose above set forth."

In pointing out the effect produced by thus placing the tubes, the patentee says, "as these tubes open below into the lower part of the boiler, and at their upper ends into the upper part of it, below the water line, the water which will become highly heated in the lower parts of the tubes, will naturally ascend, and that with considerable rapidity, towards the upper part, where they will give out their steam, and by the action of the water circulating through them, they will necessarily draw the water in the lower part of the boiler towards them, and effect the required circulation."

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32. For a *Smut Machine;* Jacob Russel, Jenner Township, Somerset county, Pennsylvania, April 24.

Two revolving beaters, each consisting of eight perforated rings on a shaft, are placed in a case one above the other, their shafts laying horizontally. The case is made of perforated metal semi-cylindrical at top and bottom, and the two semi-cylindrical parts connected by vertical sides.

The patentee says, "I do not claim the mode of arranging the revolving beaters, the one set over the other, as herein set forth; but what I claim is the arranging them in a case formed with a double concave so that each series of fans, or beaters, shall revolve in a separate concave, as described."

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33. For improvements in the *Duplex Escapement for Watches;* Charles Edward Jacot des Combes, Baltimore, Maryland, April 30.

The patentee says, "my improvements consist of a new and improved mode of constructing the escapement, called by me the American Duplex Escapement, and also of an improved mode of rendering the movement of the seconds independent." We will not attempt a sketch of the construction of these improvements, as this could not be

done to any advantage without drawings; the claim refers throughout to the drawings, and could not be understood without them.

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34. For improvements in *Stoves for Heating Apartments;* William Frazier, city of Brooklyn, New York, April 30.

A cylindrical drum is placed alongside of the stove and communicating with it by two pipes one above and the other below the grate. The drum, or radiator, is divided into four parts by two partitions at right angles to each other, one of them extending from the top to near the bottom, and the other from the bottom to near the top; by this arrangement it will be seen that when the draft is carried through the drum, or radiator, it passes down one of the divisions under the partition, up and over the second, down the third, and under the partition to the fourth, from which it passes out through the pipe into another such radiator, or into the chimney. In each of the divisions is placed a pipe opening into the room at top and bottom for the air of the room to circulate through. The claim is to the combination of the partitions and pipes in the drum, or radiator. The number of drums, or radiators, can be increased at pleasure.

This stove resembles, and is designed as an improvement on, that patented by Denison Olmsted, of New Haven, Connecticut, on the 5th of November, 1834, a description of which will be found in vol. xv, of this Journal, page 407.

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35. For an apparatus for the *Treatment of Club Foot;* John B. Brown, M. D., Boston, Massachusetts, April 30.

The foot board of this apparatus is made in two parts, united by a joint so that the forward part, or that which receives the front part of the foot, can be turned to the right or left, by means of a screw in the heel part, the threads of which take into cogs on a sector attached to the forward part. "The remaining portions of the apparatus are similar to that heretofore used, with the exception of the upright standard," which is so constructed that it can be applied to legs of different lengths, by having the part of the standard to which the strap is attached made separate from the standard, and provided with a slot so as to attach it to the main part of the standard by screws, the slot allowing it to slide out or in, and thus to regulate the length. The patentee says that in some instances he connects the heels and toes of the two feet by means of yokes, which consist of two metal rods having their ends turned at right angles and fitting in a hole made in a metal ear attached to the heel and toe of the apparatus, so that by having one of these rods, or yokes, connecting the heels and another the toes of the two feet, the length of each being properly regulated, the "patient will be enabled to walk by taking short steps, until the muscles become accustomed to their new action, and the bones acquire their relative and natural position. When one foot only is deformed, a shoe is applied to the well foot with ears at the toe and heel for the insertion of the yokes."

The claim is confined to the mode of constructing the foot board in two parts, and to the manner of yoking the two feet together.

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36. For an improved mode of constructing the feeding part of *Straw Cutters;* Israel W. Groff, Lampeter Township, Lancaster county, Pennsylvania, April 30.

On the crank shaft which is placed across the machine under the straw box and about midway between the ends of the machine, there are two double cams at right angles to each other; one of them works a lever which is connected to, and operates, a dog, or hand, which is drawn up by a spiral spring, so as to make it catch on the underside of a ratchet wheel on the upper feed roller. A spiral spring keeps the lever against the cam. The hand or dog which works the ratchet wheel on the under feed roller is hinged to the first mentioned dog, or hand, so that the two feed rollers are operated together. The second cam actuates a lever which works the bearer by means of a rod which connects the two. The bearer is a block which rests upon the straw in front of the feed rollers, it is suspended to the ends of two arms projecting from a shaft, which has another arm at one end projecting from it at right angles to the two first mentioned, and to this last is jointed the rod which connects with the lever worked by the second cam. By this arrangement it will be seen that as the cam moves the lever the bearer will work up and down. The bearer and the upper feed roller have their bearings in an iron frame, the back end of which is jointed to the straw box. A spiral spring draws down this frame so as to press the upper feed roller and bearer on the straw. The cams are so regulated that before the feed rollers are turned the bearer is lifted up to allow the straw to be forced forward, and as soon as this has been effected the bearer is forced down again to press the straw preparatory to cutting. The claim is confined to the foregoing device for working the feed rollers, in combination with the bearer.

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37. For an apparatus for *Adjusting the Grinding Surfaces of Artificial Teeth;* James Cameron, city of Philadelphia, Pennsylvania, April 30.

The teeth when prepared are attached to two plates, the upper one for the teeth of the upper jaw, and the lower one for the teeth of the lower jaw. These plates are connected to a vertical rod on a standard, in a manner similar to that of the sliding reading lamp and its stand. The upper plate does not slide up and down, but can be drawn in and out, and set in an oblique position, and there retained by a set screw which passes through the vertical rod and acts on the round stem of the plate. The lower plate slides up and down on the rod and can be fixed at any point by a set screw. Like the upper one, it can receive any oblique position and is hinged so as to imitate the working of the under jaw. A rod attached to a slide may be placed at any point below it, to answer as a rest. By means of these plates

and adjustments the grinding surfaces of artificial teeth can be regulated and adjusted with the greatest nicety.

As the claim refers to the drawings, it would be useless to give it here, and we will therefore merely state that it is confined to the combination of the plates and standard rod, the rest for the lower plate and to the mode of regulating the motion of the lower plate.

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38. For improvements in the machine for *Picking and Opening Wool, Cotton, &c.;* George C. Kellogg and Phineas Gillett, New Hartford, Litchfield county, Connecticut, April 30.

The first improvement is in the mode of feeding the wool, or other fibrous substances, into the picking machine, and consists of a feeder roller with teeth all over its surface, which revolves nearly in contact with a concave, or shell, the lower edge of which receives the wool, cotton, &c., from the creeper cloth, where it is taken by the teeth of the feeder and carried up to the upper edge of the concave, or shell, where it is caught by the teeth of the picker. The upper edge of the shell extends up to a level with the axis of the feeder and whence it is turned down and forms a concave for the picker. The second improvement is in the mode of attaching the teeth to the lags of the picker cylinder by inserting them in holes made in the lags, and then securing them by means of screws, staples, or bolts, that pass through the lags at right angles to, and embrace, the teeth. By loosening the screw staples, or bolts, the teeth can be set or removed and replaced at pleasure.

The claim is to the combination of the feeder and shell, and to their combination with the picker cylinder; and also to the method of holding and setting the teeth in the lags by means of the screw staples or bolts, as described.

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39. For an improved *Process in the Art of Tanning Leather;* Richard T. Downing and George D. Smith, Philadelphia, Pennsylvania, April 30.

(See Specification.)

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40. For a *Seed Planter;* Lorenzo and Samuel H. Bachelder, Hampstead, Rockingham county, New Hampshire, April 30.

This patent is taken for an improvement in those parts of a seed planter which open the ground and conduct the seed from the dropping wheel to the furrow prepared for it. The dropping tube, or conducting pipe, is made in the back part of the coulter, and on each side of the coulter there is a wing, or share, and these two shares are united in front to a chisel-shaped projection, or nose. The under side of the double share is concave, and directly in front of the lower opening of the dropping tube there is a bar, or cross sill, running across the concavity for the purpose of smoothing the bottom of the furrow to receive the seed. The claim is to the combination of the coulter with

the share, nose, and bar, or cross sill, as described, and also to the combination of the dropping tube with the other parts named.

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41. For an improvement in *Fire Places to Prevent Smoking;* Horner Roberts, Delhi, Delaware county, New York, April 30.

The patentee says, "the nature of my invention consists of certain new and useful arrangements of curved and straight cast and wrought iron plates in and above the throat of the chimney by which the wind is prevented from blowing though the throat into the fire place and driving the smoke and fire into the room, and by which the draught is increased by the air becoming heated from said plates, and also said arrangement preventing an entrance of persons to the interior of the house through the chimney and fire place.

The form and arrangement of the plates could not be made intelligible without drawings. The claim is to the arrangement of the plates by which the effect specified is produced.

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42. For an improvement in the *Stump Extractor;* Frederick A. Stewart, Catherine, Chemung county, New York, April 30.

This patent was granted for an improvement on a stump extractor patented by Willard Foster, of Oswego, Tioga county, New York, on the 22nd of April, 1831, a notice of which will be found in the eighth volume of this Journal at page 167, and is merely for making the lever, to which the chain is attached, which passes around the stump, of two pieces, which are opened at the bottom to straddle the stump, they are joined together at the top, and are connected about midway by a cross piece; this is used in place of the single lever attached to a cross piece at the bottom, which rests on the ground by the side of the stump, as used by Foster. The objection alleged against Foster's is that from its peculiar construction when applied to a large stump, requiring the greatest amount of leverage, the foot of the lever has to be removed to a greater distance from the centre of the stump, thus decreasing the leverage, whereas when made as above, the lever can straddle the stump and its foot be placed as near the centre of the stump, as desired.

The claim is to "the construction of the lever as before described, so that the angle formed by the inclination of the lever and chain attached to the stump can be decreased at pleasure, independent of the size of the stump."

The patentee of the above is the owner of the patent granted to Willard Foster, and there are not, therefore, any interfering claims.

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43. For improvements in machinery for *Preparing and Spinning Flax and Hemp;* Moses Day, Roxbury, Suffolk county, Massachusetts, April 30.

The fibres of flax, or hemp, are prepared by means of teeth on three cylinders. The teeth are arranged in rows, each row attached

to a slide working within the cylinder, and passing through slots in the peripheries of said cylinders. The sets of teeth are projected beyond the surfaces of the cylinders during a portion of their circuit, and are drawn in during the remainder of their circuit, this is effected by having the ends of the slides, to which the teeth are attached, working in cam, or eccentric, grooves, made in plates at each end of the cylinders—the plates remaining permanent while the cylinders revolve. The fibres pass over the first cylinder, under the second, and over the third, where they are brought together to form the roving, or roping, and pass through a tube, or regulator, from whence the roving passes to the flyer to be spun. The tube, or, regulator, is connected by means of levers, and their appendages, to a latch which throws the cylinders in and out of gear, so that when the cylinders, or the preparative part of the machinery, supplies too much material, the roving becomes too large and moves the regulator which throws the preparative part of the machinery out of gear.

An improvement is claimed in the spinning part of this machine for the purpose of giving a back and forth motion to the spindle (the spindle being horizontal) to wind the yarn on the bobbin; this device consists of a single threaded screw on the spindle, which for this purpose passes out a considerable distance beyond the back of the flyer; there is also an arrangement of pullies and bands which could not be clearly understood without drawings, the claim to this part refers throughout to the drawings.

The claim is to "the combination of the revolving drums and several rows of teeth with the machinery within said drums for operating the several series of teeth, or metallic points, as described. The regulator as described, and the combination of the regulator with the several different series of teeth, formed as described, (those near the sides of the drums being shorter than those near the centre of the same,) which arrangement, in conjunction with the peculiar shape of the regulator, forms the roving. Also stopping the preparative part of the machinery by means of the regulator in combination" with the arrangement of levers, clutch, &c. And finally to the arrangement made for imparting a reciprocating rectilinear motion to the spindle.

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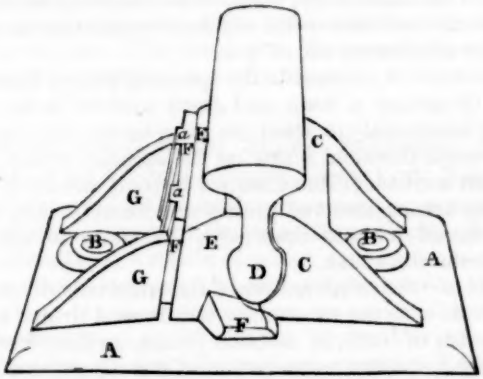
44. For a method of *Stiffening Rocket Staffs;* John W. Cochran, New York, April 30.

The patentee says, "what I claim as my invention, and desire to secure by letters patent, is the method of stiffening rocket staffs by means of metallic stiffeners in the form of cylindrical metallic tubes, or with a cylindrical metallic tube having flanches, or with the metallic flanches, as above described." It is only necessary to say that wood is put upon the outside of the metallic part, indicated in the above claim, to complete the rocket staff.

Specifications of American Patents.

Specification of a Patent for an Improvement in the manner of constructing the Chairs for Railroads. Granted to William Dripps, ***Coatsville, Chester county, Pennsylvania, April 8th,*** 1840.

To all whom it may concern: Be it known that I William Dripps, of Coatsville, in the county of Chester, and state of Pennsylvania, have invented an improvement in the manner of constructing the chairs for sustaining and holding the edge rails for railroads; and I do hereby declare that the following is a full and exact description thereof:



The accompanying drawing gives a perspective view of my railroad chair, embracing a portion of a rail. A A, is the sole or basement of my chair, which may be bolted down by bolts passing through the holes B B, or fastened in any other way which may be preferred. C C, is a cheek cast solid with the sole A A, and so formed as to receive one half of the lower part of the rail D; the other half is embraced by the separate casting E E, which has a jog F, cast on each of its ends, which jogs embrace the lower part of the cheek C C, and prevent E E from moving laterally. When E E is dropped into its place, and made to embrace the rail, it is confined there by means of the wedge plate F F, one side of which bears against it, whilst the other side is supported by the cheek C C, cast solid with the sole A A. The wedge plate F F, has ledges *a a*, upon its back, to guide and keep it in place, and it may have a cross ledge to receive the end of a crow-bar when it is required to be raised. It will be seen that by this manner of constructing railroad chairs, the respective pieces by which the rail is held in place cannot possibly became loosened by the vibration of the rail, or from any other cause, as the wedge plate, which confines the whole, will always tighten itself by its own gravity, and will consequently keep the whole firmly in place.

Having thus fully described the manner in which I construct my railroad chair, and shown how the same operates in producing the

intended effect, what I claim therein as of my invention, and desire to secure by letters patent, is the particular combination of the respective parts thereof, constructed, formed, and operating substantially as set forth, that is to say, I claim the combination of the cheek piece C C, with the separate cheek piece or casting, E E, and the plate wedge F F, producing their combined effect in the manner described.

WILLIAM DRIPPS.

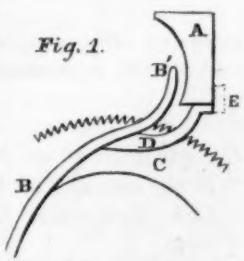
Specification of a Patent for constructing and affixing the Ribs of Cotton Gins. Granted to ASA COPELAND, JR., *Bridgewater, Massachusetts, April 8th,* 1840.

To all whom it may concern: Be it known that I Asa Copeland, Jr., of Bridgewater, in the county of Plymouth, and state of Massachusetts, have made certain improvements in the manner of constructing and affixing the ribs or grates of saw gins for ginning cotton, and I do hereby declare that the following is a full and exact description thereof:

In the saw gin as ordinarily constructed, the cotton is liable to collect in the spaces between the ribs and around them, above the point where the saws operate, thus choking or clogging the grate and preventing the rising and free escape of the fibres and seed therefrom. To obviate this inconvenience, instead of attaching the ribs by their upper ends directly to the part usually denominated the breast or grate fall, I in general extend a brace or arm out from near the upper ends of said ribs, by which to attach them to the breast in such a manner as that they shall stand out from said breast, and leave a free space of the fourth of an inch, more or less, for the escape of the cotton. The attachment may be made to the front, bottom, or back of the breast, and the mode in which this is effected will admit of much variation without departing from the general principle on which the improvement is founded.

In the accompanying drawing, fig. 1 represents a section of the breast A, with a rib B, attached to it, C being one of the saws. D is a brace or arm extending out from the under side of the rib, and attached by a screw to the under side of the breast at E. I sometimes carry the end E up on the back side of the breast, and screw it to that part, as shown by the dotted lines, or it may be carried up on the front and there attached. The arm D may be round or flat where it leaves the rib B, and it should be made narrower than the rib, say about two-thirds of its width. The top end B stands at a distance of one-fourth of an inch, or nearly so, from the lower part of the breast, the distance increasing towards the extreme end, so as to remove all obstruction out of the way of the ascent of the fibres of cotton.

Fig. 1.

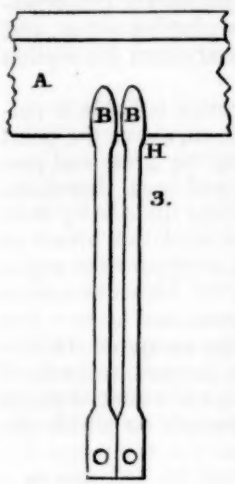


In the above described arrangement, the teeth of the saw pass be-

tween the ribs at a point above the branching off of the arm D, as shown in fig. 1, but I sometimes omit this arm and attach the rib in another manner to the front of the breast, in which case it may be constructed as shown in fig. 2, in which F is a piece extending above the point or upper end of the rib, through which it is screwed to the front of the breast, it being so formed as to sustain the end, B, of the rib at a distance from the breast, similar to the part B' in fig. 1. G is a wing or flat piece projecting out from the rib, and which is let into the breast; the whole of the said rib is above the saw, and the fibres pass freely up on either side of it and escape with the seed at the top. Although this mode of construction has been found to answer a good purpose, that first described is preferred.

2.

Fig. 3 shows the form which I give to the faces or outsides of the ribs, A being a portion of the breast or grate fall, with two of the ribs attached thereto; at the part H where the saw terminates, I widen them out as shown in the drawing, so as to narrow the space between them, and then again narrow them off towards the point, to aid in affording an unobstructed rise and escape of the fibres and seed.



3.

What I claim as my invention and improvement in constructing and affixing the ribs of saw gins for the ginning of cotton, is the so forming and affixing them to the breast or grate fall as that their upper ends shall stand off from the front of said breast in the manner herein described, in order to allow of a free and uninterrupted rise and escape of the fibres and seed from the upper ends of said ribs, and this I claim, whether the said ribs be formed and attached precisely in the manner set forth or in any other way which is substantially the same, and by which a like result is obtained.

ASA COPELAND, JR.

Specification of an Improved Power Loom, by which it is adapted to the weaving of Counterpanes. Granted to ERASTUS B. BIGELOW, *Lancaster, Worcester county, Massachusetts, April 24th,* 1840.

To all whom it may concern: Be it known that I, Erastus B. Bigelow, of Lancaster, in the county of Worcester, and state of Massachusetts, have invented a new and improved mode of constructing the power loom, by which improvement it is adapted to the weaving of figured counterpanes and to other articles of a similar character; and I do hereby declare that the following is a full and exact description thereof.

My improvements consist principally in the manner in which the shuttles are thrown; the manner of raising and depressing the shuttle boxes, and the manner in which the picker is relieved from the shuttle.

In throwing the shuttles I cause the two picker staves to operate simultaneously, so that the shuttle may be thrown from whichever of the boxes is presented to their action. This is effected by the use of one picker treadle only, which is acted upon by a cam ball, in the usual way of working such treadles. From this treadle two bands are extended, and pass around the two picker pulleys, in such manner that when the treadle is depressed, both the picker staves will be set in action at the same moment. By this arrangement two or more shuttles may be successively thrown from the same end of the loom by the action of one treadle.

The shuttle boxes are raised and lowered in the following manner. A shaft extends along under the race beam, from one shuttle box to the other, and carries pinions which take into racks attached to the shuttle boxes; it will be manifest, therefore, that by causing this shaft to revolve, the shuttle boxes may be raised. The revolving of this shaft is effected by the action of a spiral, or other, spring, one end of which is attached to the frame of the loom at its back, and said spring extends forwards towards the lathe; from this forward end a band, attached to it, passes around guide pulleys, and also around a pulley upon the above named shaft, to which latter the said band is attached. The action of the spring, by its drawing upon the band, will cause the pinion shaft to revolve, and will consequently raise the shuttle boxes. Should this spring be thrown out of action, and the band by which the shuttle boxes are raised be relaxed, they will then descend by their own gravity. To take off the tension of the spring there is a cam upon the main shaft of the loom, which cam, as the shaft revolves, depresses a treadle, to the end of which a band is attached which operates in such a way as to relieve the shuttle boxes from the action of the spring, and they then descend.

In relieving the picker from the point of the shuttle, I make use of the protection rod constituting a part of the apparatus employed in the ordinary power loom for stopping the loom when the shuttle does not arrive home in the shuttle box. From the protection rod, which extends along below the shuttle boxes, I allow a small arm, or finger, to descend, which finger, as the lathe comes up towards the breast beam, strikes against a stop, or pin, attached for that purpose to the frame of the loom, causing the protection rod to rock or revolve to a short distance. This gives motion to two arms which extend out from the extreme ends of the protection rod, opposite to the outer ends of each of the shuttle boxes; from these arms motion is communicated to a lever which works on a fulcrum over the outer ends of each of the shuttle boxes, said arms being connected to the levers by rods, or wires. By depressing the outer ends of these levers their inner ends are raised, and to these ends are appended rods which carry pieces of wood or metal which when down rest on and embrace the picker rod, and in that position they serve to hold the picker at a short distance from the end of the shuttle box, and to stop the shuttle; the picker is then

removed from the point of the shuttle by the raising of the lever, the picker being made to pass home to the end of the box, thus leaving the shuttle and shuttle box free to be raised or lowered without obstruction, the picker being also ready again to act on a shuttle. The picker is removed from the point of the shuttle, after the block has been raised by a rod, actuated by a spring, which rod is connected with the picker stave by a cord, in order that the stave may, by its motion, move the rod, also that it may not impede the motion of the picker.

Having thus fully described the nature of my improvements, and shown the manner in which I carry the same into operation, what I claim as constituting my invention, and desire to secure by letters patent, is, first, the manner in which the picker staves are operated upon by a single treadle so as to act simultaneously, whereby two or more shuttles may be thrown successively from the same shuttle box, if required; the apparatus therefor being constructed substantially as set forth. Secondly, I claim the raising the shuttle boxes by the action of a spring, or springs, weight, or weights, and the allowing them to descend by their own gravity when the tension of the spring, or the force of the weights, is taken off; the same being effected in the manner described, or in any other analogous thereto. Thirdly, I claim the relieving of the shuttle from the picker, by means of an apparatus constructed and operating as herein described, that is to say, by the combined action of the levers, the pieces of wood or metal, and the rods, connected by cords to the picker stave, connected and operating substantially as described.* ERASTUS B. BIGELOW.

Specification of a Patent for an improvement in the art of Tanning. Granted to RICHARD T. DOWNING *and* GEORGE D. SMITH, *of the city of Philadelphia, April 30th,* 1840.

To all to whom these presents shall come: Be it known that we, Richard T. Downing and George D. Smith, of the city of Philadelphia and state of Pennsylvania, have invented a new and useful improvement in the art of tanning, and that the following is a full and exact description of our said invention and of the manner and process of making, constructing and using the same.

In the process of tanning leather by suspending hides in liquor, on what is termed Brown's Patent Reels, or any other mode of suspending or immersing the hides in liquor, it has been found impossible to produce thereby a durable color, or bloom, as is produced by handling leather up and down in liquor, at first, and subsequently by laying away in liquor with a stratum of bark between each hide or half hide. In consequence of this apparent deficiency in the system of tanning by suspending hides in liquor until they are tanned, the most approved tanners of that class have had to resort to the expedient of laying away their leather in vats suitable for the purpose with strata of bark between, as before described, thus incurring additional expense and loss of time.

* In the original there are drawings, with references thereto.

Now it has been discovered, by the applicants, that immediately upon the suspension of the hides in the liquor, a sediment commences to collect upon the grain, or surface, of the hide, and to adhere to it so firmly as to prevent the natural action of the bleaching, or blooming, properties of most bark and other liquors containing the tannin principle, upon the removal of which obstruction the liquor acts upon the hide so as to form the most perfect and uniform color and bloom, similar, or superior, to that which is obtained by means of laying away with bark as aforesaid.

The removal of this sediment also facilitates the operation of tanning, and increases the pliableness of the leather. For this purpose we have constructed a cleansing brush made by the insertion of stiff bristles, say from three to four inches long, (depending on the space between the hides) on each side of a board from one to one and a half inch thick, six to ten inches wide and eighteen to twenty-four inches long, made in the form of a paddle, with a handle about seven feet long. This brush is furnished with bristles all around it. When used, this brush is placed between two sides suspended as aforesaid, and placed grain to grain, and worked up and down by hand, by which the sediment is prevented from collecting on the surface of the leather.

What we claim as our invention or discovery is an improvement in the art or process of tanning by cleansing the hides whilst suspended in bark or other liquor containing the tannin principle, by means of a brush with a long handle, made and used as above set forth, in order to prevent the collection of any sediment, dirt or impurity upon the surface, or grain, of the leather, and thus to allow the liquor to act, to produce gradually the commencement of the process, the desirable color, or bloom, and giving the tannin a free access through the pores to unite with the gelatine of the hide.

RICHARD T. DOWNING,
GEORGE D. SMITH.

Proceedings in an Appeal from the decision of the Commissioner of Patents, HENRY L. ELLSWORTH, ESQ., *rejecting the application of* JOHN F. KEMPER, ESQ., *of Cincinnati, Ohio, for a Patent for an Improvement in the Manner of Stowing Ice.*

[CONCLUDED FROM PAGE 359.]

Opinion of the Chief Justice.

The petition of John F. Kemper sets forth that he "has *invented* certain *improvements* in the manner of constructing vessels for the stowing and carrying ice; and also *an improvement in the manner of stowing the same;* and prays that letters patent of the United States may be granted to him *therefor*, securing to him and his legal representatives an exclusive right in and to his said invention agreeably to the provisions of the acts of Congress in that case made and provided; he having paid thirty dollars into the Treasury of the United States, and otherwise complied with the requirements of the said acts."

In his specification, after describing his vessel and the improvements in the same, and certain matters to be attended to in the stowing of the ice, he says:

"I have discovered that for the purpose of keeping ice for a great length of time it is necessary in stowing it, to place all the pieces edgewise, as, when placed flatwise, small openings are formed through it by the percolation of water or otherwise, and that this injurious effect goes on increasing, and eventually producing a rapid destruction thereof; this I obviate by carefully packing all the blocks edgewise, when, as experience has abundantly shown, no such effect is produced. This mode of stowage applies not only to vessels, but also to ice houses, and whenever ice is to be preserved."

After stating what he disclaims, and what he claims as his invention and improvements in constructing vessels for the transportation of ice, he says:

"In the manner of stowing the ice I claim the placing of the prepared blocks edgewise, in the manner and for the beneficial purpose herein set forth."

No objection was made by the Commissioner of Patents to the grant of a patent for the novel construction of vessels for the transportation of ice, as claimed by him; but the Commissioner decided that the applicant was not entitled to receive a patent for the manner of stowing the ice by placing the blocks edgewise.

From this decision he has appealed according to the provisions of the 11th section of the act of March 3d, 1839, and the 7th section of the act of July 4th, 1836; and has filed in the patent office his reasons of appeal, and paid the sum of twenty-five dollars to the credit of the patent fund.

By the 11th section of the act of March 3d, 1839, ch. 88, (pamphlet edition) the Judge is to confine his revision to the points involved in the *reasons of appeal;* and the Commissioner of patents is to lay before the Judge, the grounds of his decision touching the same point.

The applicant claims a patent for his vessel, and his manner of stowing ice in vessels and ice houses, as one invention, and pays thirty dollars as for one patent.

The Commissioner denies his right to a patent for his manner of stowing, but admits it for his improvement in the construction of his vessel.

The first and principal point involved in the reasons of appeal, is whether the thing for which the patent is claimed is the invention or discovery of a new and useful art, or of a new improvement on an art, within the meaning of the Constitution and laws of the United States respecting patents.

The invention, if it be one, consists only in laying each block of ice on its narrowest side. Can that act be considered as a new thing invented or made? Was it never done before? If it has been done before, although the *beneficial effect* of so placing it, rather than on its broadest side, had not been discovered, it is not a new thing. The only thing new is the discovery of the beneficial effect—and that is the discovery of a thing which existed before, for if it is now true that ice so placed keeps longer than when differently placed, it was always true—and that it existed before is shown in the specification where it is said that the effect was discovered by *experience.*

Much of the confusion of ideas upon this subject has arisen from the ambiguity of the words "*discover*" and "*discovery*" used in the Constitution and the patent laws of the United States. In their primary and common sense they are not synonimous with "*invent*" and "*invention.*"

Webster, in the last 8vo. edition of his dictionary, under the word "*discover,*" says, "*discover* differs from *invent.* We *discover* what *before existed.* We *invent* what did *not before exist.*" And under the article "*invention*" he says, "*invention* differs from *discovery*, invention is applied to the contrivance and production of something that did not before exist. *Discovery* brings to light that which *existed before*, but which was not known."

A discovery, in this sense, is not the subject of a patent; and it will be found, by a careful perusal of the Constitution and Laws of the United States upon the subject of patents for useful arts, &c., that it is not there used in this sense but always as synonimous with *invention.*

Thus the Constitution (in ch. 4, art. 1, sec. 8, clause 8,) among the enumerated powers given to Congress, says—"To promote the progress of science and useful arts, by securing, for limited times, to authors and *inventors* the exclusive right to their respective writings and *discoveries.*"

Here it is evident that the "*discoveries,*" the use of which is to be secured, are the discoveries of *inventors* only. The applicant must invent, contrive, or produce something that did not exist before. A man may *discover* (i. e. may disclose) his *invention;* and for that discovery or disclosure he will be entitled to the exclusive use of his *invention* for a limited time.

In the first act of Congress "to promote the progress of useful arts," passed April 10, 1790, the words *invention* and *discovery* are used synonimously throughout the whole act; and whether application was for a patent, for an invention, or a discovery, it must be founded upon an invention or discovery of an useful art, &c., (or improvement therein,) not before known or used. The discovery of a new art, that will justify a patent under that act can be only the *invention* of a new art, and the discovery of a new improvement the *invention* of a new improvement. In every case, therefore, the applicant must be the inventor; and by the Constitution none but *inventors* could be entitled to the monopoly.

The next act was passed on the 21st of February, 1793, entitled "an act to promote the progress of useful arts; and to repeal the act heretofore made for that purpose."

By the first section of this act, the applicant was to declare that he had *invented,* not discovered, a new and useful art, &c., or improvement, &c., and the patent was to give a short description of the said invention or *discovery.* Here "*discovery*" is intended to be synonimous with invention, for the claimant had alleged an *invention only;* and it is afterwards again, in the same section, called, the said invention or *discovery.* The second section says that any person who shall have *discovered* an improvement and obtained a patent therefor shall

not be at liberty to use "the original *discovery*, nor shall the first *inventor* (i. e. of the *original discovery*, which he had alleged to be his *invention*,) be at liberty to use the improvement." And a change of form or proportions, was not to be "deemed a *discovery*." By the third section every *inventor* was to swear or affirm that he believed that he was "the true inventor or *discoverer* of the art," &c., and deliver a written description of his *invention*, by which it may be distinguished from other *inventions*.

The fourth and fifth sections speak of *inventors* and *inventions* without saying any thing of discoverers, or discoveries.

The sixth section, alluding to the same *invention*, calls it "his *discovery*," and speaks of *original discovery*, and *supposed discovery*, and the *discovery of another man*, and all these expressions are used in reference to what had been patented as *inventions*. The tenth section speaks of the *true inventor or discoverer*, and the eleventh section provides that every *inventor* shall pay thirty dollars before he presents his petition.

The act of the 17th of April, 1800, only extends the privileges of the former act to aliens and to the legal representatives of *inventors* and *discoverers*, &c., and gives treble damages for violation of patent rights.

The act of July 13th, 1832, applies only to aliens.

The next act is that of July 4th, 1836, entitled "an act to promote the progress of useful arts, and to repeal all acts and parts of acts heretofore made for that purpose."

The first section speaks of "issuing patents for new and useful *discoveries, inventions and improvements*," as part of the business of the Commissioner of Patents whose office was therein created.

In the fifth section the words *invention* and *discovery* as used throughout are synonimous.

The sixth section, which declares for what a patent may issue, shows that the applicant must have "*discovered* or *invented* some *new* art, &c., or improvement, and it is called "his discovery or invention thereof," and he is called the *inventor* or *discoverer*. It then says, "but before any *inventor* shall receive a patent for any such new *invention* or *discovery*, he shall deliver a written description of his *invention* or *discovery*. The descriptions and drawings are to be signed by the *inventor*, and he is to furnish a model of his *invention*, and he is to make oath that he does verily believe that he is the original and first *inventor* or *discoverer* of the art, &c., or improvement, for which he solicits a patent; and that he does not know or believe that *the same* was ever before known or used."

In the seventh section wherever the word *discovery* or *discoverer* is coupled with invention or inventor, it is evident that it means the discovery or discoverer of something *new*, something that did not exist before, and therefore equivalent to *invention* and *inventor*. In the latter part of the section it speaks of the science to which the alleged *invention* appertains, and of the part, or parts, of the *invention* which he, the Commissioner, considers as not entitled to be patented.

The eighth section speaks of the right of an *original and true in-*

ventor to a patent for his *invention*, and says nothing of a *discovery* or *discoverer*.

The twelfth section speaks only of *invention* not discovery, yet it is evidently applicable to the former sections which use the words *invention* or *discovery*.

The thirteenth section provides that where a patent shall be "invalid by reason of the patentee claiming in his specification, as his own *invention*, more than he had a right to claim *as new*, the Commissioner may cause a new patent to be issued to the said *inventor* for the same *invention*, &c. The same section afterwards speaks of a "description and specification of any new improvement of the original *invention* or *discovery* which shall have been *invented* or *discovered by him*, the patentee, subsequent to the date of his patent."

The fifteenth section specifies the special matter which may be given in evidence by the Defendent under the general issue, among which is evidence tending to prove that the description and specification filed by the Plaintiff does not contain the whole truth relative to his *invention* or *discovery*, or that the patentee was not the original and first *inventor* or *discoverer* of the *thing* patented, or of a substantial and material part thereof claimed *as new;* or that he had surreptitiously, or unjustly, obtained the patent for that which was, in fact, *invented* or *discovered* by another. It also speaks of "the *invention* or *discovery* for which the patent issued." It speaks also of the first *inventor* without adding *discoverer;* and of the *invention* without adding *discovery*.

The sixteenth section speaks of the *invention* patented, and generally of *inventions* without adding discoveries.

The seventeenth section speaks of injunctions to prevent the violation of the rights of any *inventor*, but says nothing of any *discoverer*, shewing that the word *inventor* included all such *discoverers* as were contemplated by the Legislature as within the protection of the *patent laws*.

The eighteenth section provides "that whenever the patentee of an *invention* or *discovery* shall desire to extend his patent beyond the term of its limitation, he may make application," &c., and shall furnish a statement of "the ascertained value of the *invention*," and having failed to obtain from the use and sale of *his invention*, a reasonable remuneration, &c., he may have the term extended. Here it is evident that the word *invention* was understood as equivalent to *invention and discovery*, mentioned in the beginning of the section; and shows that the discovery contemplated was the discovery of something *new*—i. e. that did not exist before, and was used as synonimous with the word *invention*.

The remaining sections of the act do not use the word *invention* or *discovery*.

The act of March 3, 1839, (Pamphlet, ch. 88, p. 74,) section seventh, says that every person who shall have constructed any "newly *invented* machine, manufacture, or composition of matter prior to the application by the *inventor* or *dicoverer* for a patent, shall be held to possess the right to use, &c., the specific machine, &c., so made, &c.,

without liability therefor to the *inventor* or any other person interested in such *invention;* and no patent shall be held to be invalid by reason of such use, &c., except on proof of abandonment of such *invention* to the public," &c.

There is nothing further in this act tending to explain the meaning of the word *discovery* as used in the Constitution and Laws of the United States respecting patents for useful arts.

Upon consideration of the Constitution and Laws of the United States upon this subject, therefore, I think I may safely say, that the claimant in this case can build no argument upon the supposed difference between a discovery and an invention; for no discovery will entitle the discoverer to a patent which does not, in effect, amount to the contrivance or production of something which did not exist before, or in other words to an invention.

The patent claimed is *for the placing of the prepared blocks edgewise*, for the purpose set forth in the specification.

The placing of the blocks of ice edgewise, is not the contrivance or production of any thing which did not exist before. It is not an invention. It is not a discovery, because every body knew before that the blocks of ice might be placed upon their narrowest side; and it is asserted by the Commissioner in the grounds of his decision, and not denied in argument, that blocks of ice have been so placed; whether by accident or design is immaterial; the placing is not new. It is not an invention.

The discovery of a new effect of that which existed before is not the subject of a patent. Blocks of ice have been placed on edge before the alleged discovery by the claimant. If they were so placed with intent to retard their dissolution, I presume the claimant would at once abandon his claim. But the intent can be no ground of a patent. The claimant may be the first who placed blocks of ice on edge *with that intent*, but this cannot justify a patent for doing that which was often done without that intent. In truth the whole merit of the claimant is the discovery of a fact which existed long before, viz. that ice placed edgewise kept longer than when placed flatwise. This is a mere naked *discovery*, for which a patent cannot be granted. There is no invention, nothing contrived or produced which did not exist before.

It is, however, contended that although the discovery, merely as such, is not patentable, and although blocks of ice may have been often placed edgewise, yet "it will not be pretended that in vessels or in ice-houses ice had ever been stowed away upon the *system* adopted by Mr. Kemper." By "*system*" I suppose must here be meant *intent* or purpose—for the placing the ice on edge cannot, of itself, form a system. A system, as defined by Dr. Johnson, is "any complex use, or combination of many things acting together; a scheme which reduces many things to regular dependence or co-operation; a scheme which unites many things in order."

The patent, in the present case, is not asked for a *system*, but for the exclusive right to place blocks of ice on their narrowest side. The claim, therefore, obtains no support by calling it a *system;* nor

by calling it a *"plan,"* as in the reasons of appeal, where it is asked, "Is the proposed *plan* unquestionably old?" What the writer meant by the word *plan* is not very obvious, but I presume he intended to refer to the placing of the ice *edgewise, with the intent* that it should thereby keep longer than if otherwise placed. He probably meant to include the *intent* with the *act;* but as before observed, if the thing done be not new, the intent cannot entitle it to a patent.

It is admitted in argument on behalf of the applicant, "that a discovery, taken abstractedly, is not patentable;" but it is contended "that if the thing discovered be practically applied to produce a new and useful effect, the manner of obtaining this end is patentable." Now let us apply this rule, or doctrine, to the present case. The thing discovered is the beneficial *effect* of the position of the ice—not the position itself. How is this *effect*, which is the thing discovered, applied by the applicant to produce a new and useful effect? and what is the new effect thus to be produced by the effect discovered? Whatever it may be, it must be produced by means that are new—by some *invention*—some contrivance or production of something that did not before exist. The beneficial effect of the position of the ice, is the retardation of its dissolution. No new and further effect is proposed. That retardation is the *ultimate* effect contemplated. No *new* means are intended to be used which can be the subject of a patent. A new effect from old means will not justify a patent for those old means. This case is, therefore, not within the rule or doctrine thus advanced to support it.

The patent to Mr. Tudor for filling the interstices between the blocks of ice with some non-conducting substance, is cited as a precedent for the present application. No judicial decision is produced affirming the validity of that patent, and it seems to me to rest upon very doubtful grounds; but it is to be presumed that the Commissioner who issued it, was satisfied that the means used were a new invention.

Mr. Dolland's patent for an improvement is also referred to, but there the means used were decided to be, as to him, a new invention, although Dr. Hall had, forty years before, constructed two telescopes upon *the same principle*, but had not pursued the matter and brought it into public use. That case has no analogy to the present.

In the reasons of appeal it is suggested that patents for *processes*, or *modes of procedure*, in preserving animal and vegetable substances by means extremely simple, have been granted in England and in this country; but as they are not particularly brought to my notice, I cannot say how far they may be considered as precedents to justify the present application. I presume that in all of them something new was invented; something more than the discovery of a fact or a principle, and the application of such fact or principle to some useful purpose by old means, or by means not newly invented.

It is also suggested in the reasons of appeal, that "the Commissioner is *bound* to issue a patent for the thing claimed, if on examination it shall not appear to him that the same had been invented or discovered by any other person in the country, prior to the alleged in-

vention or discovery thereof by the applicant, or that it had been patented or described, &c., as stated in the seventh section of the act of July 4, 1836; and that the *discovery* in question is not placed in either of the conditions that would justify the refusing of a patent, under the law.

But the seventh section refers to the sixth, by which it appears that a patent is to be issued only to a person who has discovered or invented some *new* and useful art, &c., or some *new* and useful improvement on any art, &c.

The Commissioner, therefore, is to decide in the first place, whether the invention is new, and whether it is the proper subject of a patent; and if he finds that it is not the proper subject of a patent, he is bound to refuse it, although it may not be liable to the particular objections specified in the seventh section.

It is also said in the reasons of appeal, that the professed rule of the office is "that where the question is at all doubtful, that a patent should be granted."

This rule, I suppose, must have been adopted when the applicant had no remedy if the Commissioner rejected his claim, and the decision of the Commissioner was affirmed by the Board of Examiners, under the seventh and sixteenth sections of the act of July 4, 1836—which last mentioned section gave the applicant a remedy by bill in equity, only in case the patent was refused on the ground that it would interfere with an unexpired patent previously granted. In all other cases of refusal, the applicant had no remedy—whereas, if the patent should be granted, its validity might be at all times questioned in the courts of law. It was reasonable, therefore, to adopt such a rule.

But now, by the tenth section of the act of March 3, 1839, if the patent be refused, for any cause, either by the Commissioner or the Judge, the applicant may still establish his right to a patent by a bill in equity.

The reason of the rule therefore fails, and I should not think myself bound by it if I thought this to be a case of doubt, which I do not.

Every patent is a monopoly, and nothing can justify it but the natural right of property which a man has in the products of his own labor and ingenuity. With this exception, it is in derogation of common right; and it should be strictly confined to the case excepted. Upon the whole, therefore, I am of opinion, and so decide, That the decision of the Commissioner of Patents, that the applicant, John F. Kemper, was not entitled to receive a patent for the manner of stowing ice by placing the blocks edgewise, was correct, and the same is hereby confirmed.

And I do hereby certify the same to the said Commissioner of Patents; and I further certify that having received an appeal and the petition herewith inclosed, of John F. Kemper, and the original papers named in the letter from the Commissioner of Patents of the 13th of February, 1841, herewith also inclosed, I ordered notice to be given, as appears in my order of the 17th of February, 1841, also herewith inclosed, which was returned to me on the 18th of Febru-

ary, 1841, with service acknowledged. I further certify that the parties appeared before me, at my chambers, on Monday, the 8th of March, 1841, when, by consent, the hearing was postponed to Monday, the 15th of March, when the applicant, by Dr. Thomas P. Jones, his Attorney, presented his written answer to the grounds of the Commissioner's decision, (which written answer is also herewith inclosed,) when the hearing was further postponed, by consent, to Wednesday, the 17th instant, and on that day further postponed until Friday, the 19th instant, when the parties attended, and the Commissioner filed his reply to the argument of Doctor Jones, which is also herewith inclosed, and the case was then submitted, without further argument. All which papers are herewith transmitted to the Commissioner of Patents, this 22nd day of March, 1841.

W. CRANCH.

Cast-Iron Tiles.

The *Memorial de la Sambre* announces that a trial has just been made in the manufactories of Gougnies, to substitute plates of cast-iron for slates and tiles. In these first specimens seventeen plates of cast-iron of a certain shape cover a square metre, and this square metre weighs on an average twenty-two kilogrammes. The same extent covered by common slates weighs twenty-one kilogrammes, and by large slates nineteen kilogrammes, and the square metre of tiles weighs forty kilogrammes. Thus, on the ground of lightness alone, cast iron plates may bear competition with slates, and they have a decided superiority over tiles. The plates of cast-iron are sold at the establishment of Gougnies at thirty centimes a piece; two centimes more when they are required to be varnished, to protect them from the wet. The value of the plates, therefore, is five francs ten centimes the square metre, and varnished plates five francs forty-four centimes. The price of these cast-iron plates is therefore not exorbitant, particularly when it is considered that the use of plates of cast-iron prevents the annual expense of repairing, which in roofs of slate or tiles average a quarter, and sometimes a third, of the first cost. Besides, there is a saving of the nails which are used to join the slates. The iron plates are fixed merely by wooden laths. It is expected that this new invention will be of great service to the iron manufacturers; many other applications of iron it is expected will result from this.

Mining Review, Dec. 1840.

LUNAR OCCULTATIONS FOR PHILADELPHIA, JUNE, 1841.

COMPUTED BY JOHN DOWNES.

Angles reckoned to the right or westward round the circle, as seen in an inverting telescope.

☞For direct vision add 180°.☜

Day.	H'r.	Min.	Star's name.	Mag.	From Moon's North point.	From Moon's Vertex.
1	12	0	Im. (282) Solitarii,	6	36°	57°
1	13	7	Em.		292	325
2	8	29	Im. π Scorpii,	3.4	75	46
2	9	52	Em.		241	225
2	14	50	Im. m Scorpii,	6	148	187
2	15	26	Em.		207	251
4			Im. p Sagittarii, 5 below the horizon			
4	9	14	Em.		283	244
			JULY, 1841.			
5	11	18	Im. 21 Capricorni,	6	165	134
5	12	17	Em.		247	225
5	14	58	Im. θ Capricorni,	5.6	70	83
5	15	47	Em.		359	22
16			Im. ϵ Geminorum,	*invisible.*		
16	15	54	Em.		295	246
28	11	53	Im. y Ophiuchi,	6	44	82
28	12	38	Em.		333	14
29	12	45	Im. g Sagittarii,	5.6	175	209
29	13	19	Em.		226	265
31	12	37	Im. 351 Sagittarii,	6	31	48
31	12	42	Em.		24	43

Meteorological Observations for April, 1841.

Moon.	Days	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inch's	Inch's			Inches	
	1	41	55	29.85	29.85	S W.	Moderate.	.03	Cloudy—rain—clear.
	2	43	68	.80	.65	SE S.	do.	.12	Lightly cloudy—do. co.—tornado
	3	38	50	.54	30.05	W.	do.		Clear—do
☉	4	36	47	30.10	.00	S S.	do.		Cloudy—do.
	5	45	55	29.6[illegible]	29.74	W.	Brisk.		Cloudy—clear.
	6	44	54	.95	30.04	W.	do.		Cloudy—clear.
	7	45	57	30.00	29.90	W.SE.	Calm.		Cloudy—do.
	8	41	55	29.70	75	NE.	Moderate.	.05	Drizzle—flying clouds.
	9	45	68	.8[illegible]	.60	S.	Brisk.		Cloudy—lightly cloudy.
	10	42	42	.70	76	E.	do.	.23	Cloudy—snow.
	11	28	38	30.0[illegible]	30.10	E.	Moderate.		Clear—do.
☽	12	32	32	.10	.00	E.	Brisk.	1.00	Snow—do.
	13	30	46	29.85	29.85	NW.	Moderate.		Cloudy—flying clouds.
	14	33	47	.75	9[illegible]	E.W.	do.	.75	Snow—flying clouds.
	15	30	4[illegible]	30.27	30.35	W.	do.		Clear—do.
	16	30	56	.40	.41	SW.	do.		Clear—do.
	17	45	58	.1[illegible]	.00	SW.	do.	.03	Drizzle—do—rain in night.
	18	58	58	29.50	29.60	SW.W.	Brisk.	.04	Cloudy—flying clouds.
	19	34	56	30.00	30.0[illegible]	W.	Moderate.		Clear—do.
	20	41	50	.00	.00	SW.S.	do.	.22	Cloudy—rain.
⊗	21	48	55	29.85	29.84	NW	do.		Clear—do.
	22	41	49	30.0[illegible]	30.00	NE.	Brisk.		Partially cloudy—cloudy.
	23	47	56	29.8[illegible]	29.90	NE SE.	do.	.35	Drizzle—rain—cloudy.
	24	49	62	.97	9[illegible]	E.	Moderate.		Cloudy—do.
	25	52	63	.97	30.00	E.	do.		Cloudy—do.
	26	51	66	.90	29.84	E.S.	do.		Cloudy—clear.
	27	51	57	.56	.64	W.	do.	.36	Rain—clear.
☾	28	4[illegible]	63	90	94	NW.	do.		Clear—do.
	29	42	45	80	50	W.S.	do.	1.25	Partially cloudy—rain.
	30	44	52	.05	.05	W.	do.	.0[illegible]	Cloudy—drizzle.
	Mean	41.63	53.57	29.88	29.88			4.49	

	Thermometer.		Barometer.	
Maximum height during the month,	68.00	on the 2nd and 9th.	30.41	on the 16th.
Minimum " "	28.00	" 11th.	29.05	" 30th.
Mean	47.60		29.88	

METEOROLOGICAL REPORT

FOR THE STATE OF PENNSYLVANIA,

Collated from returns made to the Committee on Meteorology of the Franklin Institute of the State of Pennsylvania, for

JUNE, 1841.

	County.	Town.	Observer.	Thermometer. 7, A.M.	2, P.M.	9, P.M.	Maximum.	Minimum.	Mean.	Days omitted.	Register. Lowest.	Mean.	Days omitted.	Barom. 7, A.M.	2, P.M.	9, P.M.	
1	Philadelphia,	Philadelphia,	G. P. Schively,	70.18	80.50	73.82	94.00	56.50	74.83	3	50.00	64.53	1	29.99	29.97	29.95	3
2	Montgomery,																
3	Bucks,	Newtown,	L. H. Parsons,	65.86	73.60	63.86	90.50	52.50	67.77	.	47.00	59.90	.	29.96	29.94	29.94	3
4	Lehigh,																
5	Northampton,	Easton,	Charles Elliot,														
6	Monroe	Stroudsburg,	A. M. Stokes,														
7	Pike,	Milford,	Ralph Bull,														
8	Wayne,	Honesdale,	W. Richardson,														
9	Susquehanna,	Silver Lake,	E. Rose,	59.50	74.17	64.53	92.00	40.00	66.06	.	40.00	55.83	.	28.06	28.07	28.03	2
10	Luzerne,	Wilkesbarre,	V. L. Maxwell,														
11	Schuylkill,	Port Carbon	P. C. Lyceum,	64.37	83.91	65.12	98.00	53.00	71.13	2	37.00	53.07	.	29.28	29.30	29.28	2
12	Berks,	Reading,	C. F. Egelmann,														
13	Chester,	West Chester,	Wm. W. Jeffris,														
14	Delaware,	Haverford,	Haverford School,	71.41	71.41	72.33	82.00	64.00	72.71	7 1/3	49.00	63.74	2	29.35	29.34	29.35	2
15	Lancaster,	Lancaster,	Conservatory of Arts,	69.27	83.00	73.37	93.00	60.00	75.21	.	54.00	64.62	.	29.46	29.45	29.44	3
16	York,																
17	Lebanon,																
18	Dauphin,	Harrisburg,	J. Heisely,	73.90	79.46	79.34	88.00	67.00	77.57	1 1/3	55.00	66.38	1	29.69	29.68	29.65	2
19	Northumberland,	Northumberland,	Andrew C. Huston,	68.23	76.80	71.87	88.00	58.00	72.30	.	45.00	60.07	.	29.43	29.40	29.40	3
20	Columbia,	Danville,	C. H. Frick.														
21	Bradford,																
22	Tioga,																
23	Lycoming,																
24	Union,																
25	Mifflin,																
26	Juniata,	Mifflintown,	J. A. Kinkead,	75.69	80.69	78.11	90.00	70.00	78.16	2 2/3	.....	.....	.	29.42	29.38	29.39	2
27	Perry,																
28	Cumberland,	Carlisle,	Prof. W. H. Allen,	73.47	79.43	76.00	88.00	68.00	76.30	1/3	53.00	63.37	.	29.36	29.34	29.34	3
29	Adams,	Gettysburg,	Prof. M. Jacobs,	72.32	73.34	73.17	85.50	64.00	72.94	.	53.00	60.66	.	29.31	29.33	29.33	3
30	Franklin,																
31	Huntingdon,	Huntingdon,	Prof. Jacob Miller,	74.76	77.85	77.97	84.00	68.00	76.82	1 2/3	.....	.....	.	29.34	29.32	29.32	3
32	Centre,	Bellefonte,	John Harris,	70.67	84.24	76.23	94.00	62.00	77.05	9	.....	.....	.	29.25	29.24	29.22	3
33	Potter,																
34	M'Kean,	Smithport,	M. R. Atkins,	62.67	76.70	64.69	87.00	50.00	68.02	1/3	40.00	54.50	.	.....	.....	.....	
35	Clearfield,																
36	Cambria,	Ebensburgh,	Richard Lewis,	65.71	76.42	70.52	87.00	51.00	70.88	3	40.00	57.61	2	28.02	27.94	27.97	
37	Bedford,	Bedford,	Samuel Brown,	74.86	78.21	76.67	84.00	64.00	76.58	2/3	.....	.....	.	29.19	29.19	29.19	
38	Somerset,	Somerset,	George Mowry,	67.00	75.12	70.54	84.00	56.50	70.89	3 2/3	45.00	60.02	2	27.85	27.86	27.84	
39	Indiana,	Indiana,	Richard White,	71.67	74.10	72.33	80.00	65.00	72.70	.	.....	... ..	.	28.61	28.61	28.61	
40	Jefferson,	Rose Cottage,	C. C. Gaskell,														
41	Warren,	Warren,	J. E. King,														
42	Venango,	Franklin,	Wm. Connely,	61.50	83.59	64.64	98.00	41.00	69.91	8	.....	.....	.	29.06	29.08	29.02	
43	Armstrong,																
44	Westmoreland,																
45	Fayette,	Uniontown,	J. P. Weethee,	71.04	80.47	76.17	89.00	61.00	75.89	.	.....	.....	.	29.01	29.01	28.97	
46	Green,																
47	Washington,	Cannonsburg,	Prof. A. H. Campbell,														
48	Alleghany,	Pittsburgh,	J. P. Bakewell,	67.87	80.43	71.90	92.00	57.00	73.40	2/3	50.00	63.87	.	29.22	29.18	29.19	
49	Beaver,	Beaver,	James Allison,	72.07	76.00	75.28	89.00	65.00	74.45	1	52.00	60.50	2	29.39	29.35	29.36	
50	Butler,	Butler,	Jacob Mechling,	68.47	81.67	74.63	94.00	52.00	74.92	.	.....	.....	.	28.78	28.78	28.80	
51	Mercer,	West Greenfield,	S. Campbell,														
52	Crawford,	Meadville,	Henry Shippen,	64.85	81.50	65.58	91.00	50.00	70.64	.	43.00	57.72	.	28.73	28.72	28.72	
53	Erie,	Erie,	Park & Reid,														

ter.					Barometer.							Weather.								
	Days omitted.	Register. Lowest.	Mean.	Days omitted.	7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum	Mean.	Days omitted.	Clear.	Cloudy.	Days omitted.	Rain.	Snow.	Rain and Snow.	Thunder Showers.	Rain in inches.	North.
33	3	50.00	64.53	1	29.99	29.97	29.95	30.21	29.71	29.97	3	14	13	3	10	.....	.....	1	3.876	3⅓
77	.	47.00	59.90	.	29.96	29.94	29.94	30.18	29.71	29.95	.	15⅗	13⅓	1	13	.....	.....	..	5.104	⅓
06	.	40.00	55.83	.	28.06	28.07	28.03	28.30	27.65	28.05	.	16⅗	13⅓	.	9	.....	.....	..	2.740	4⅓
13	2	37.00	53.07	.	29.28	29.30	29.28	29.45	29.09	29.28	2	13⅓	14	2⅗	9	.....	.....	..	4.685	⅗
71	7⅓	49.00	63.74	2	29.35	29.34	29.35	29.55	29.13	29.34	7⅓	11	11⅗	7⅓	8	.....	.....	2	5.573	2
21	.	54.00	64.62	.	29.46	29.45	29.44	29.65	29.21	29.45	.	16⅗	13⅓	.	6	.....	.....	2	3.755	2⅗
57	1⅓	55.00	66.38	1	29.69	29.68	29.65	29.84	29.45	29.67	1⅓	.	.	.	9	.....	.....	2	3.205	.
30	.	45.00	60.07	.	29.43	29.40	29.40	29.58	29.18	29.41	.	10⅗	19⅓	.	8	.....	.....	2	2.692	2⅓
16	2⅓	.....	.....	.	29.42	29.38	29.39	29.57	29.17	29.40	1⅗	14⅓	13⅗	2	6	.....	.....	1	2.200	⅗
30	⅓	53.00	63.37	.	29.36	29.34	29.34	29.50	29.13	29.34	⅓	16	13⅗	⅓	8	.....	.....	..	4.065	⅗
94	.	53.00	60.66	.	29.31	29.33	29.33	29.49	29.15	29.32	.	17⅓	12⅗	.	8	.....	.....	..	2.887	4⅓
82	1⅗	.....	.....	.	29.34	29.32	29.32	29.47	29.14	29.32	1⅗	18	12	.	9	.....	.....	..	3.486	.
05	9	.....	.....	.	29.25	29.24	29.22	29.38	29.05	29.24	9	12⅓	8⅗	9	2	.....	.....	2	3.788	1⅗
02	⅓	40.00	54.50	.	.....	.....	.....	.....	.....	.....	.	17⅗	12⅓	.	.....	.....	.....	..	.....	.
88	3	40.00	57.61	2	28.02	27.94	27.97	28.10	27.74	27.98	3	10	17	3	4	.....	.....	5	3.570	1
58	⅗	.....	.....	.	29.19	29.19	29.19	29.33	29.01	29.19	⅗	17⅓	12	⅗	.....	.....	.....	..	.....	⅗
89	3⅗	45.00	60.02	2	27.85	27.86	27.84	28.00	27.68	27.85	3⅗	10⅗	15⅓	3⅗	8	.....	.....	4	5.502	⅗
70	.	.....	.....	.	28.61	28.61	28.61	28.70	28.50	28.61	.	21⅓	8⅗	.	11	.....	.....	..	2.200	.
91	8	.....	.....	.	29.06	29.08	29.02	29.70	28.70	29.05	8⅓	.	.	.	7	.....	.....	..	1.927	.
89	.	.....	.....	.	29.01	29.01	28.97	29.12	28.70	29.00	.	25⅓	4⅗	.	5	.....	.....	4	4.700	.
40	⅗	50.00	63.87	.	29.22	29.18	29.19	29.38	29.01	29.20	⅓	13⅓	16⅓	⅓	8	.....	.....	3	5.464	⅓
45	1	52.00	60.50	2	29.39	29.35	29.36	29.55	29.20	29.37	1⅓	15	13⅗	1⅓	6	.....	.....	2	6.413	⅗
92	.	.....	.....	.	28.78	28.78	28.80	29.00	28.60	28.78	.	.	.	.	5	.....	.....	3	3.366	⅓
64	.	43.00	57.72	.	28.73	28.72	28.72	28.86	28.53	28.72	⅓	11⅗	16⅓	2	.....	.....	.....	..	.....	2⅗

Rain in inches.	Winds.																	Hygrometer.					No. of Report.
	North.	N. N. E.	N. E.	E. N. E.	East.	E. S. E.	S. E.	S. S. E.	South.	S. S. W.	S. W.	W. S. W.	West.	W. N. W.	N. W.	N. N. W.	Calm.	Days omitted.	Dew-point.	Days omitted.	Diff. therm. and dew-point.	Wet Bulb.	Days omitted.	
3.876	3½	.	2⅔	⅓	1⅔	½	3½	.	4	⅛	5	⅔	2⅛	½	1⅛	.	.	4	....	.	.....	....	..	1528
5.104	⅛	.	4⅓	.	⅛	.	4	⅔	2	.	5⅓	1	3	.	7½	⅔	.	½	....	.	.....	....	..	1523
2.740	4⅛	.	2⅛	.	.	.	.	.	6	.	5	.	5	.	6⅔	⅔	.	.	....	.	.....	....	..	1546
4.685	⅔	.	3	.	2	.	1	.	1⅛	.	2⅔	.	8⅛	.	⅓	.	8⅔	2	....	.	.....	....	..	1517
5.573	2	1	⅔	1⅛	2	⅔	1	⅛	2½	1⅛	5	1⅔	2⅛	2	1	⅔	1⅓	3⅛	61.60	10	.....	71.65	10	1530
3.755	2⅔	⅓	2⅔	.	⅓	1	2⅔	1	4⅔	1	1⅔	3⅔	4	1⅓	1⅓	1⅔	.	.	62.94	.	.....	68.90	.	1520
3.205	.	.	.	.	6	.	4	.	⅔	.	6⅔	.	7	.	4½	.	.	1⅓	....	.	.....	....	..	1509
2.692	2⅓	⅓	2	.	2	.	4½	⅓	6⅓	.	1	.	4½	⅓	1⅓	.	5⅓	.	....	.	.....	70.42	..	1510
2.200	⅔	.	⅓	.	⅔	.	3	.	.	.	3⅔	.	1⅔	.	1⅓	.	17⅓	1⅓	....	.	.....	....	..	1516
4.065	⅔	.	2⅔	.	2	.	2	.	3⅔	⅓	3	⅔	4½	1	2	.	7⅓	⅓	62.05	1	.....	67.86	1	1511
2.887	4⅓	⅛	1⅔	⅓	⅓	.	⅛	1	8	1	3⅔	1	1⅔	⅔	⅓	⅓	5	.	64.11	.	.....	69.61	..	1527
3.486	.	.	.	.	8⅔	.	.	.	.	.	.	.	21	.	.	.	.	1⅛	....	.	.....	....	..	1533
3.788	1⅔	.	1	.	⅛	⅛	⅛	.	3	.	1⅔	⅔	2⅔	⅛	.	.	1	17	....	.	.....	....	..	1518
.....	.	.	1	.	5⅛	.	2	.	1	.	5⅓	.	10⅓	.	5	.	.	.	....	.	.....	....	..	1529
3.570	1	.	.	.	.	.	1⅓	⅔	1	.	7⅔	.	6	⅛	5	.	4⅓	2⅔	....	.	.....	....	..	1515
.....	⅛	.	.	.	.	3⅛	4⅔	.	⅓	.	4⅓	1	2⅓	11	2	.	.	⅔	....	.	.. .	....	..	1512
5.502	⅔	.	.	.	.	.	⅔	.	3⅓	.	2⅔	1⅔	5⅓	.	⅓	.	11⅔	3⅔	....	.	.....	76.26	7	1532
2.200	.	.	.	.	⅓	.	⅓	.	.	.	1⅔	.	9	.	1⅔	.	16⅔	⅓	....	.	.....	....	..	1635
1.927	.	.	.	.	.	.	2⅔	.	.	.	4	.	.	.	13⅓	.	.	10	....	.	.....	....	..	1531
4.700	.	.	⅓	.	.	.	⅛	.	⅓	.	10	.	6⅓	.	8	.	4⅔	.	....	.	.....	....	..	1605
5.464	⅛	.	⅛	⅔	⅛	.	3⅔	.	.	.	1⅔	.	2	⅔	6	⅛	13	1	....	.	.....	....	..	1513
6.413	⅓	.	⅔	.	⅛	⅛	5	⅓	.	.	3	.	.	⅓	10⅓	⅓	7	1⅔	....	.	.....	....	..	1588
3.366	⅓	.	1	.	8⅓	.	.	.	.	.	9⅓	.	10	.	1	.	.	.	....	.	.....	....	..	1524
.....	2⅔	⅛	⅔	.	⅔	.	1⅔	⅓	2	.	⅔	.	1⅔	.	2⅓	⅓	14	2⅔	....	.	.....	....	..	1514

LUNAR	
Day.	H
1	1
1	1
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